Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

JUNE, 1960

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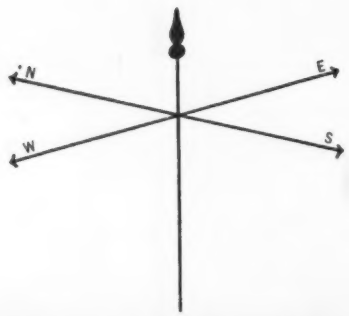

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Check this listing for the distributor in your area and call him today.

You will find your local dealer to be a recognized, established firm offering prompt, efficient and courteous service.

His thorough and extensive knowledge of the plating industry can help you select the proper rectifier and control for your particular requirement.

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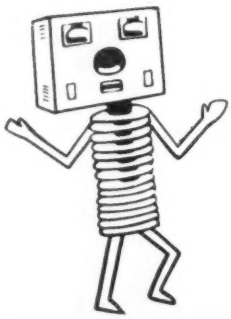
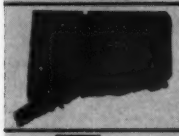


CALIFORNIA
Industrial Materials Co.
3838 Brannon Street
San Francisco, Calif.
EXbrook 2-8505



CONNECTICUT

Hubbard-Hall Chemical Co.
Apothecaries Hall Division
28 Benedict Street
Waterbury 88, Conn.
PLaza 6-5521

Foy Electro Chemical Co.
P.O. Box 164
Ansonia, Conn.
REgent 5-3331

Lea Manufacturing Co.
16 Cherry Avenue
Waterbury 20, Conn.
PLaza 3-5116

ILLINOIS
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Chicago, Illinois
CApital 7-8800

MASSACHUSETTS

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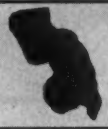
CHestnut 1-7343



NEW JERSEY

Daniels Plating Barrel & Supply Co.
129 Oliver Street
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MArket 3-7450

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538 Forest Street
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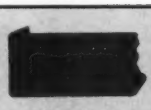

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A free-flowing powdered blend of acid salts, activators and surfactants. Water soluble. Packed in non-returnable containers. Less expensive than 50% muriatic acid, superior activating and wetting ability. No special equipment needed. No special handling or safety problems. Non-fuming at room temperatures. Produces cleaner activated surfaces that allow shorter plating times.

1. Strips chromium rapidly without current
2. Prevents cloudy, stained nickel plate
3. Provides good adhesion on zinc die castings, copper and brass
4. Descales heat-treated, welded, or brazed steel without attack
5. Allows re-nickel plating on top of old passive nickel plate
6. Dissolves red rust
7. Activates steel prior to plating or phosphating
8. Prepares cast iron for plating
9. Removes soldering flux

Write today for complete technical data. Enthone, Inc., 442 Elm Street, New Haven, Conn.

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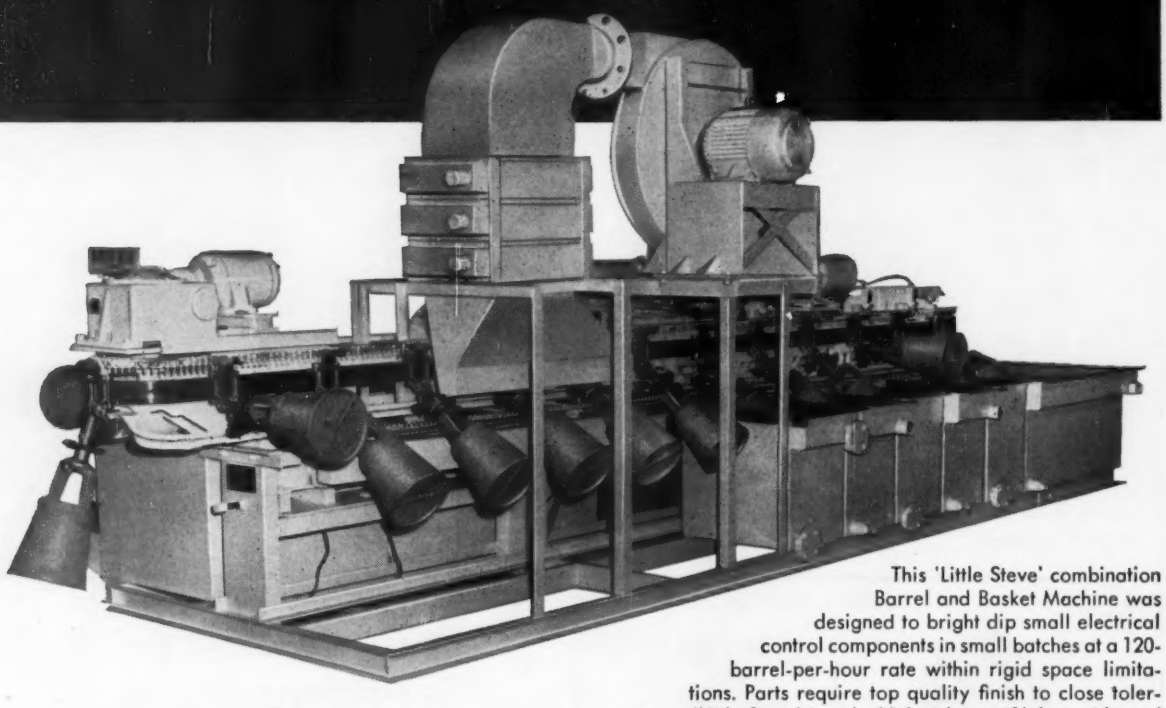
ENTHONE

A Subsidiary of American Smelting and Refining Company

METAL FINISHING is published monthly by Metals and Plastics Publications, Inc., 381 Broadway, Westwood, N. J., U.S.A.
SECOND CLASS POSTAGE PAID at the Post Office in Westwood, N. J. and New York, N. Y. Volume 58, No. 6, June, 1960. Five dollars per year.

Now there's a member of the famous 'LITTLE STEVE' family to handle ALL your plating and processing jobs!



This 'Little Steve' combination Barrel and Basket Machine was designed to bright dip small electrical control components in small batches at a 120-barrel-per-hour rate within rigid space limitations. Parts require top quality finish to close tolerance; 'Little Steve' is only 23 feet long, 6¾ feet wide and normally, 4 feet high. Special built-in dryer shown is an optional feature.

'Little Steve' automatic barrel machines

Now you can precision plate and process small, intricate parts automatically with the new, low-cost 'Little Steve' Barrel Machine. Floor space requirements are kept to a minimum. Fully automatic cycling, as well as automatic loading and unloading features, provides fast, efficient processing of parts to meet your specific requirements. Stevens popular oblique barrels eliminate the need to open and close covers manually.

This completely new addition to the famous 'Little Steve' family of automatic processing equipment is ideally suited to integrated manufacturing methods. Investigate its many benefits today.

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Prove to yourself . . . on your own lathes, why so many finishers say that no other buff can compare with

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Kanigen®

helps keep jet aircraft where the money is ...in the air

Big jet aircraft make money only when they are in the air. Every minute they are earthbound is costly. You just can't take chances on failure of aircraft engines from fuel contamination, or on failure of refueling equipment. That's why those parts of Brodie BiRotor refueling meters and control valves that come in contact with the fuel are chemically plated with KANIGEN nickel alloy.

Brodie BiRotor meters have been used for controlling aircraft refueling for many years, and their internal parts have been KANIGEN-coated ever since this highly accurate method of plating difficult or complicated surfaces was perfected.

Do you have a corrosion or contamination problem? Is it a small part like the Brodie meter housing? Or is it a surface as large as the inside of a 20,000 gallon tank car? Whatever it is, there's a way to solve your problems with KANIGEN chemical nickel plating. Write or phone the nearest General American office.

It pays to plan with General American.

GENERAL AMERICAN TRANSPORTATION

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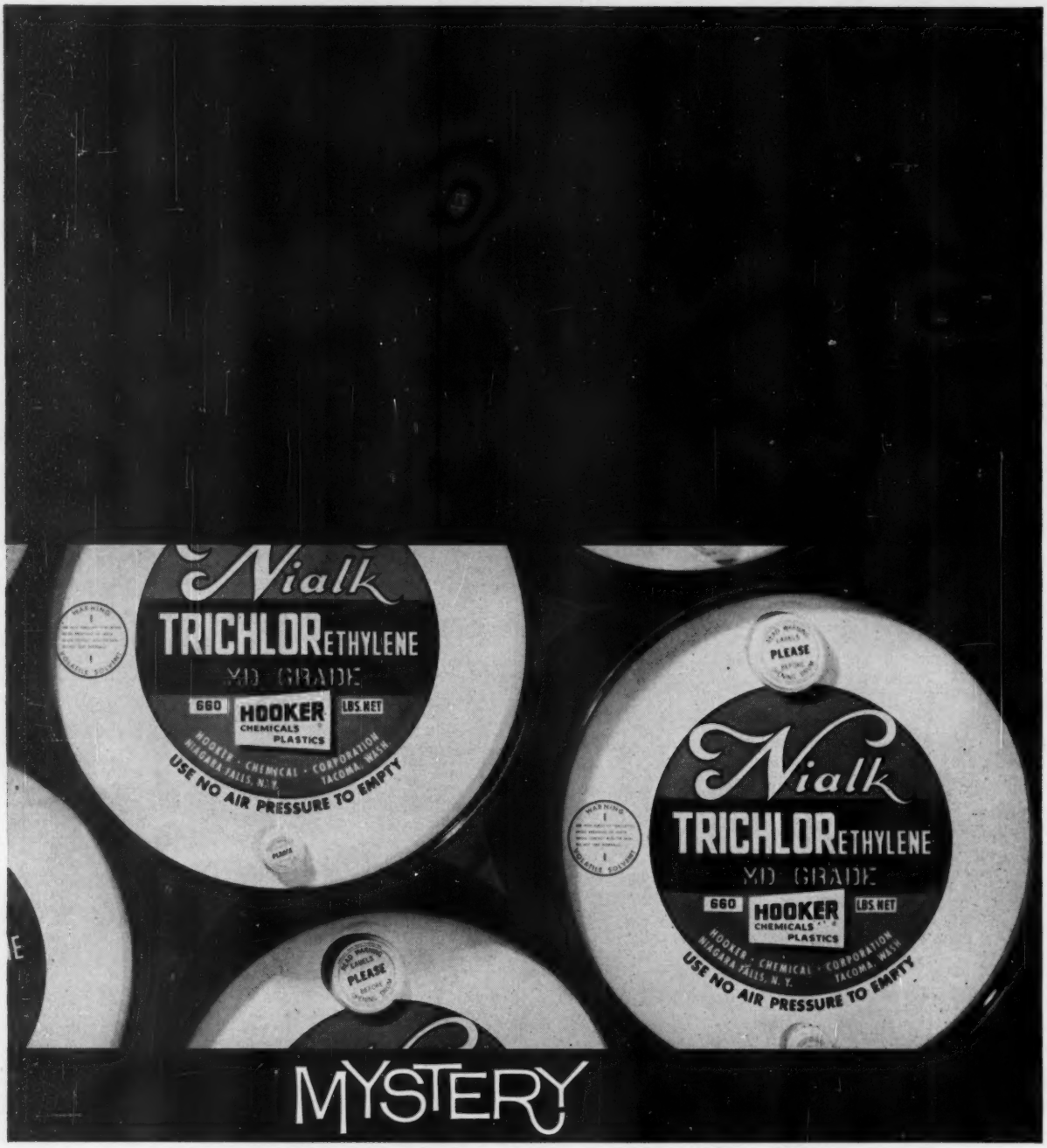
KANIGEN GENERAL AMERICAN



HOW ONE GRADE DOES TWO JOBS

Nialk® MD Grade Trichlorethylene is pure enough for flushing missile components and low enough in cost for degreasing. That's because we've made it non-impact sensitive in the presence of liquid oxygen and because we've held residue on evaporation to 0.0005% max.

Because one and not two grades is needed, you cut your inventory, lower your costs, avoid mistakes.

Another thing that makes Nialk Trichlorethylene so good is PSP (permanent staying power). A neutral stabilizer system protects against heat, air, light, moisture, acids and active metals. It can't wear out, doesn't let your solvent go sour.

If you would like complete information on Nialk Trichlorethylene, ask for Bulletin 44A and Data Sheet 814. Meanwhile, why not try a few drums (or a tank car) of Nialk brand. You will find that your trichlor dollars buy more at Hooker.

Nialk® Trichlor, a product of
HOOKER CHEMICAL CORPORATION
1306 Union Street, Niagara Falls, N. Y.

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DAW JUNIOR

FULLY AUTOMATIC PLATING MACHINE

(Furnished For Rack Or Finger Type Plating)

Unloads Automatically Only plating machine in the industry that unloads racks or fingers without operator's attention.

Selective Cycling Automatic by-passing of tanks—or any combination of cycles—can be arranged on the Daw Jr.

Minimum Dragout Cam lift, between tank transfers, tilts work above horizontal which practically eliminates dragout regardless of workpiece shape or size.

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Fast And Economical The most versatile, most efficient machine ever designed for fast, low-cost plating of small and medium size parts.

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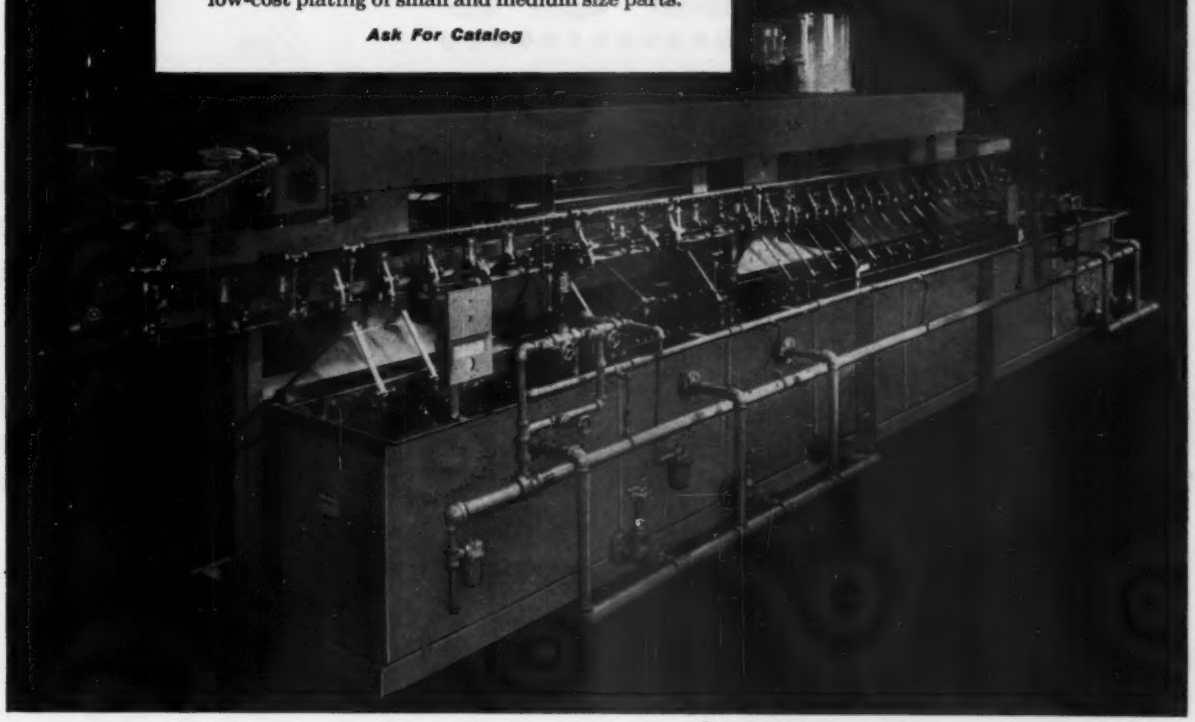
AUTOMATIC UNLOADING

AUTOMATIC CYCLE SELECTION



LASALCO, INC.

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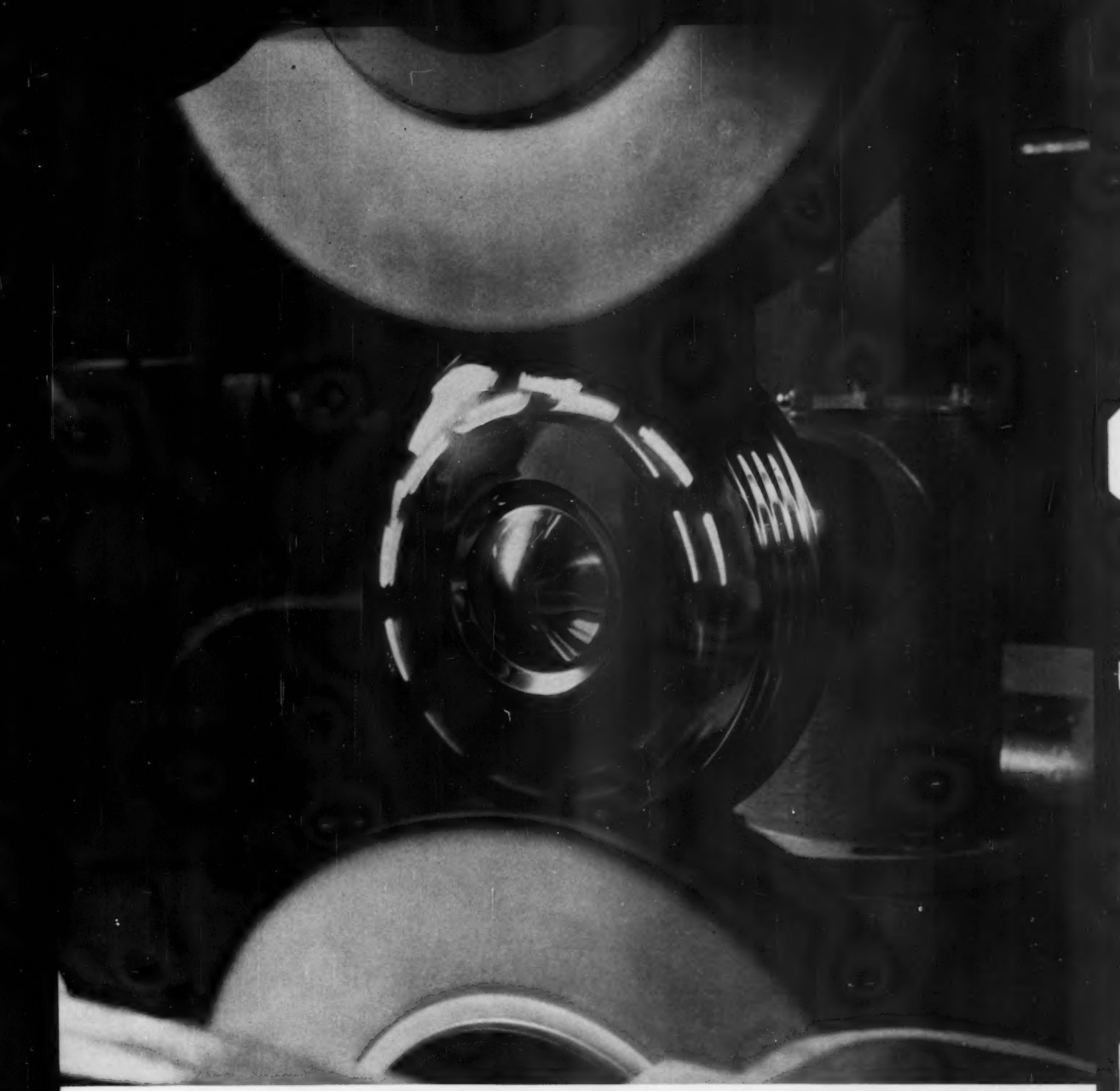
IN TEXAS: 2805 Allen St. • Dallas, Texas • Riverside 7-8093

ATTACH TO COMPANY LETTERHEAD

Send complete information on Daw Jr. Automatic Plating Machine

Name.....

Title.....



whatever your finishing problem

ACME has—or will design—a machine to solve it

Buffing automobile hubcaps with this versatile, compact Acme two-headed buffing lathe saves time, saves space and cuts production costs. Faster than ever before, and in one automatic high-speed operation this multiple station unit removes "orange peel," pits and other surface blemishes from the curved surfaces of the part. It gives the hubcap an extra smooth, flawless, high-luster finish, ready for plating. ■ This is the kind of efficiency that cost-conscious companies, both large and small, expect . . . *and get* . . . from versatile Acme finishing machines. Basic machine designs achieved over fifty years give Acme customers an advantage of selecting one of many equipment arrangements, even for the most specialized finishing applications. ■ Automotive trim, building hardware, electrical and plumbing fixtures, household appliance and kitchenware, primary metal sheets and coils . . . these are some of the many mass-produced parts and products now served efficiently by Acme machines. If you have a finishing problem call or write for comprehensive catalog today.

ACME MANUFACTURING COMPANY

1400 E. 9 MILE ROAD, DETROIT 20 (FERNDALE), MICHIGAN
LEADING PRODUCERS OF AUTOMATIC POLISHING & BUFFING MACHINES SINCE 1910

In steak or plating, thickness counts. A good thick layer of Nickel under the chrome will give your product a finish that not only *looks* like quality but also *keeps* that look despite hard use.

Brushed Nickel-Chrome...an enduring finish that gives a quality look at a practical cost

Look at the door of this built-in oven ... at the top of the drop-in range.

The rich beauty you see is brushed Nickel-Chrome Plating.

You may have heard of this finish as "brushed chrome" or "satin chrome." By any of these names, brushed Nickel-Chrome Plating offers you a way to dress up your products at little — if any — increase in production cost!
Here are five big reasons why:

Quality Appearance. A brushed Nickel-Chrome finish tells your customer that the article he is buying is of high quality — inside as well as on the surface.

Durability. This finish keeps on saying "quality" despite hard use. One or even two punishment-taking layers of Nickel, flash-coated with chrome, resist nicking, scratching, wearing, and corrosion. What's more, this finish resists staining, is easy to clean.

Easy to Fabricate. Brushed Nickel-Chrome can be ... is being applied to all the easy-to-fabricate metals — steel, zinc, aluminum, copper, brass — to take advantage of the physical and mechanical properties of these metals. Less common metals can also be readily plated.

Versatility. Brushed Nickel-Chrome has many unique advantages. For example, by selective buffing, you can get bright trim effects without using trim hardware.

Practical Cost. Experience of manufacturers already using brushed Nickel-Chrome shows that this eye-catching finish costs only a few pennies more than ordinary finishes.

With Nickel in ample supply as far into the future as any man can see, you can take advantage of brushed Nickel-Chrome Plating to give your products extra sales appeal. For more ideas, write for our booklet, "Practical Answers to 40 Practical Questions about Nickel Plating."

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street INCO New York 5, N. Y.

INCO Inco Nickel... *makes plating perform better longer*

To 14 of the 21 leading companies making cars and automotive supplies, Unichrome Coating 218X on the plating racks is a good investment. This plastisol insulation is so tough that damage is a rarity—and long life the rule. It won't chip, crack, tear . . . is highly resistant to abrasion. Racks stay sleek, smooth, tightly sealed in severest plating operations—minimize contamination and drag-out problems.

Because of this extended service life and reduced maintenance, users' costs are minimum. All agree that the best quality saves money in the long run.

Why not follow the leaders' preference for Coating 218X. If you don't apply it yourself, nearby experienced specialists can do it for you. Contact us for details. METAL & THERMIT CORPORATION, General Offices, Rahway, New Jersey.

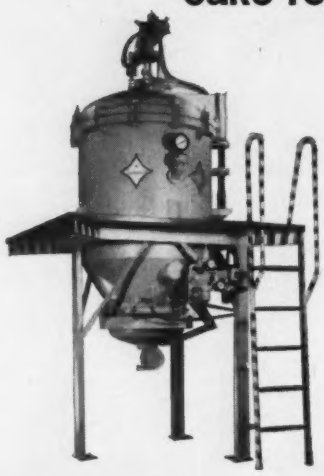
M&T **coatings and finishes**
METAL & THERMIT CORPORATION

2 OF EVERY 3 LEADERS IN THE AUTOMOTIVE INDUSTRY

...coat plating racks with Unichrome Coating 218X!

photo courtesy: Ford Motor Co.

SAVE TIME and EFFORT WITH MODERN FILTERS



These rapid cleaning devices on INDUSTRIAL filters offer tremendous advantages to the user through removal of, and subsequent disposing of waste materials or recovery of valuable solids.

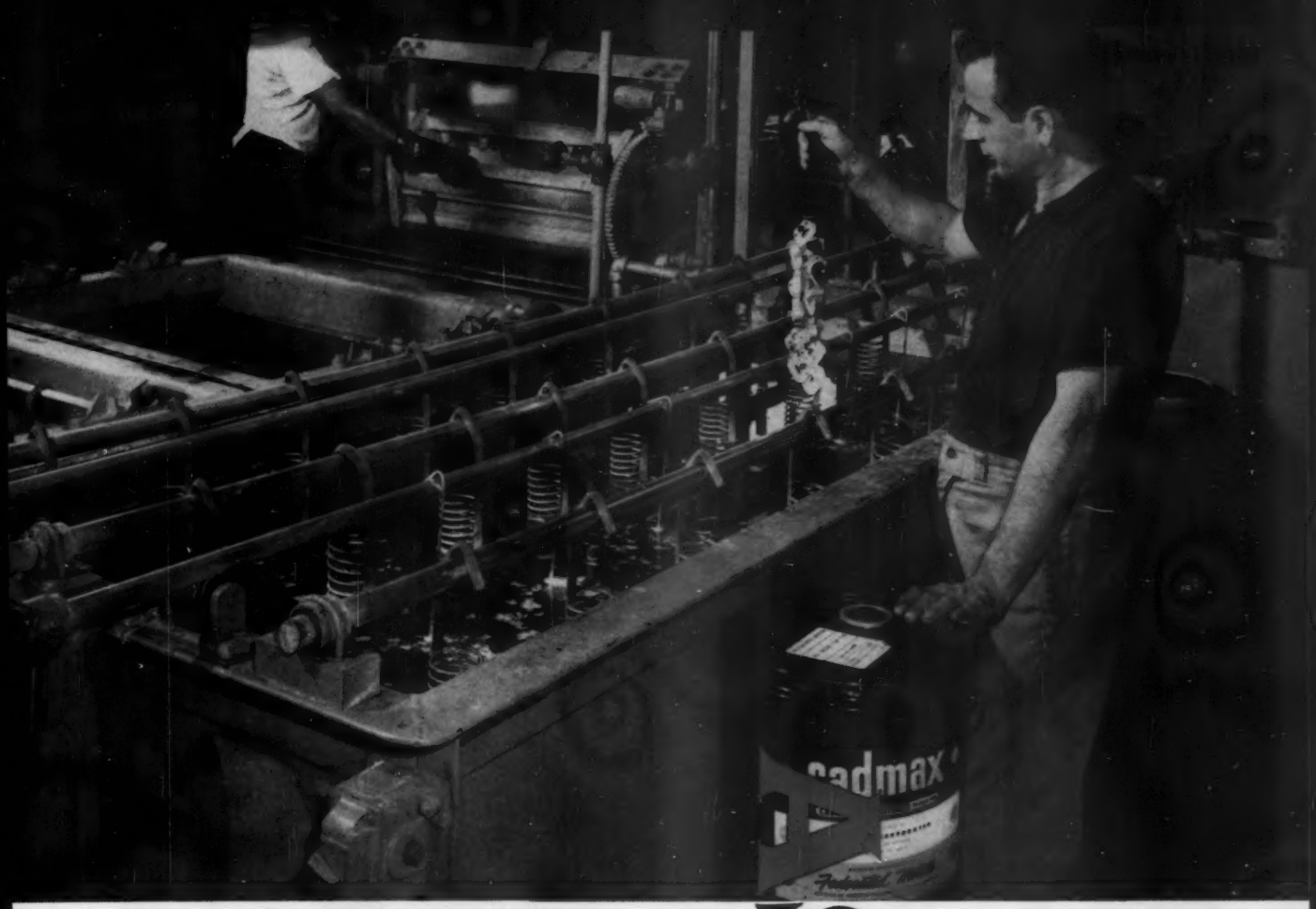
For additional information write for Bulletin EP-100.

With VIBRA-SHOC or RECIPRO-SHOC, cleaning of your INDUSTRIAL filter is completed in minutes. The above mentioned trade named devices are obtainable on INDUSTRIAL'S TYPE 152 filters, as are such optional equipment as QUICK OPENING COVERS, LIQUID SHOC and AIR WASH, all designed with the efficiency you require for your particular operation. All these mechanical aids work for you to realize a definite cost savings based on reduced downtime, for either continuous or batch type operation. These self-cleaning devices also eliminate the manual dirty work in handling any dry, wet or semi-solid material.

INDUSTRIAL

INDUSTRIAL FILTER & PUMP MFG. CO.
5906 West Ogden Avenue, Chicago, Illinois

PRESSURE FILTERS ♦ ION EXCHANGERS ♦ CORROSION TEST CABINETS ♦ PUMPS ♦ WATER & WASTE-TREATING EQUIPMENT



Competitively proven!

FEDERATED PLATING ANODES, BRIGHTENERS, NICKEL SALTS

You can guarantee consistent high grade results with Federated plating materials, developed, perfected, and competitively tested and proven. In addition to standard brass, cadmium, copper, lead, nickel, tin, tin-lead, and zinc anodes, there are new **Asarcomax** copper anodes and triple-life Conducta-Core lead anodes. **Cadmax** (cadmium), **Zimax** (zinc), **Levelmax** and **Nimax** (nickel), brighteners have set industry standards for performance. Federated nickel salts are of the highest purity and uniformity. Write or call for full information to Federated Metals Division, American Smelting and Refining Company, New York 5, RE 2-9500, or call our nearest sales office, or get in touch with your nearby Federated Plating Materials Distributor

ASARCO

AMERICAN SMELTING AND REFINING COMPANY

FEDERATED METALS DIVISION

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SEATTLE 4, WASHINGTON
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WHITING, IND. (CHICAGO)
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Chicago: Essex 5-5000

IN CANADA: Federated Metals Canada, Ltd.
Toronto, Ont., 1110 Birchmount Rd., Scarborough, Phone: Plymouth 73246

Montreal, P.Q., 1400 Norman St., Lachine, Phone: Melrose 7-3591

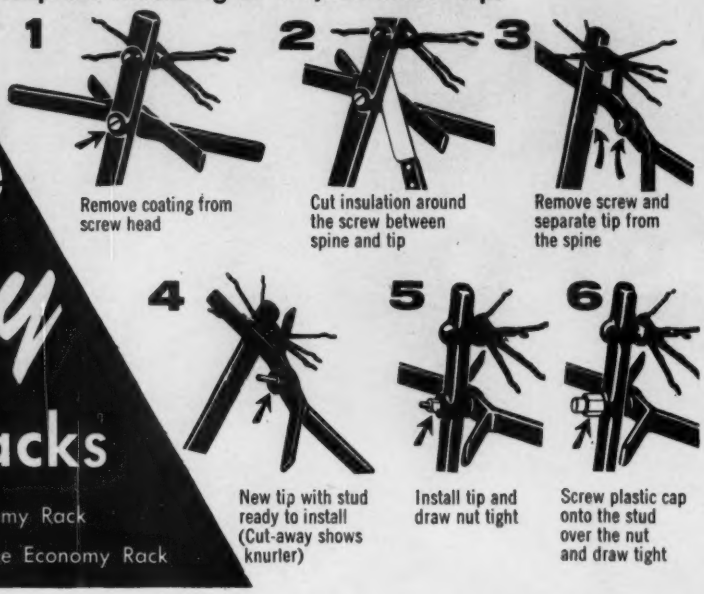
New Heavy Duty Convertible Economy Plating Racks

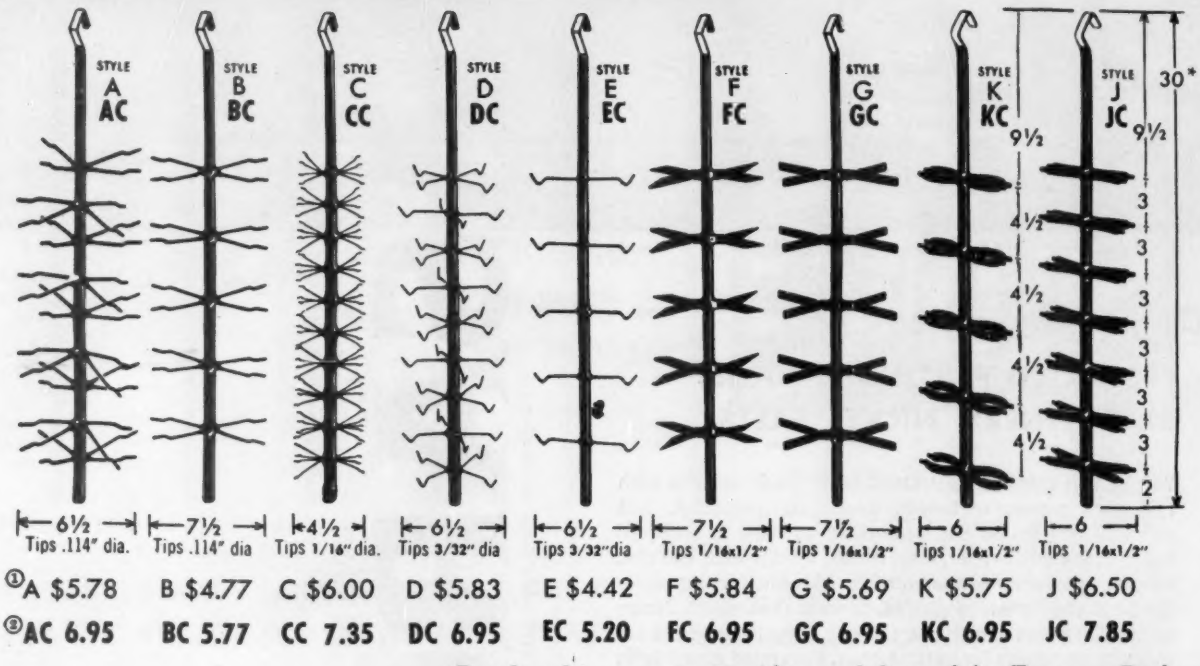
from fixed tip to replaceable tip

One letter designates Non-convertible Economy Rack

Suffix "C" designates Heavy Duty Convertible Economy Rack

Leakproof Mounting of Replacement Tips





①A $5.78	B $4.77	C $6.00	D $5.83	E $4.42	F $5.84	G $5.69	K $5.75	J $6.50
②AC 6.95	BC 5.77	CC 7.35	DC 6.95	EC 5.20	FC 6.95	GC 6.95	KC 6.95	JC 7.85

①Cat. No. and Prices of Non-Convertible Economy Racks.

②Cat. No. and Prices of New, Heavy Duty, Convertible Economy Racks.

*36 inch lengths also available.

All prices F. O. B. Chicago, subject to change without notice.

Add $1.50 packing charge on orders for less than 12 racks.

No variations at these prices except in mass production quantities.

Developed in response to widespread demand for Economy Racks that could be kept at 100% capacity through endless years of use. These NEW Convertible Economy racks have special rivited tip assembly that is easily removed for replacement with pre-insulated, self-sealing THINKER BOY Tips.

The Convertible Economy Rack Spines are 25% heavier. Quality construction—mass production economies make possible the low prices.

Belke MANUFACTURING COMPANY
947 N. Cicero Ave., Chicago 51, Ill.
EVERYTHING FOR PLATING PLANTS

HARSHAW

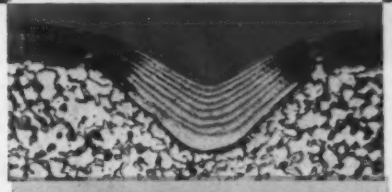
HARSHAW Airglow

AIR-AGITATED BRIGHT NICKEL PROCESS

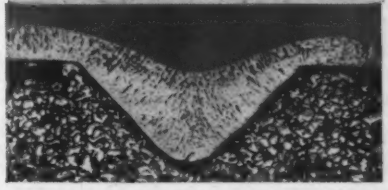
Gives you insurance against air supply failure because it operates efficiently with any agitation system.

Airglow allows the use of current densities much higher than attainable from mechanically agitated systems.

Levelling effects of Harshaw Airglow Bright Nickel deposit compared to that of Harshaw Perflow leveling semi-bright nickel.



TOP: Airglow Bright Nickel—1.5 mil deposit—depth of groove 3.1 mils.
BOTTOM: Perflow Semi-bright Nickel—1.5 mil deposit—depth of groove 3.2 mils.



- Airglow depth of color and brightness unequalled.
- Airglow corrosion resistance—the best of any bright nickel.
- Airglow gives levelling comparable to Perflow levelling!
- Airglow gives economies unusual for bright nickel.

Let us show you!

Allow us to give you the complete story on this outstanding process by contacting the nearest Harshaw office.

THE HARSHAW CHEMICAL COMPANY

1945 EAST 97th STREET • CLEVELAND 6, OHIO

CHICAGO 32, ILLINOIS • CINCINNATI 13, OHIO • CLEVELAND 6, OHIO • DETROIT 28, MICHIGAN • HASTINGS-ON-HUDSON 6, N.Y. • HOUSTON 11, TEXAS • LOS ANGELES 22, CALIF. • PHILADELPHIA 48, PA. • PITTSBURGH 22, PA.

Plating Processes also available through the following Foreign Distributors or Manufacturers:

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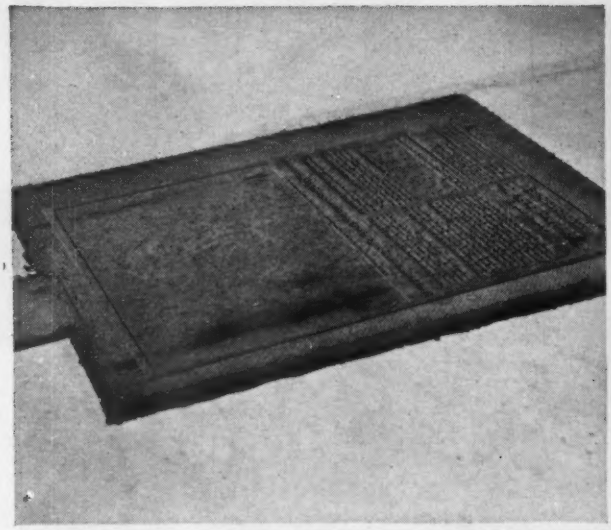
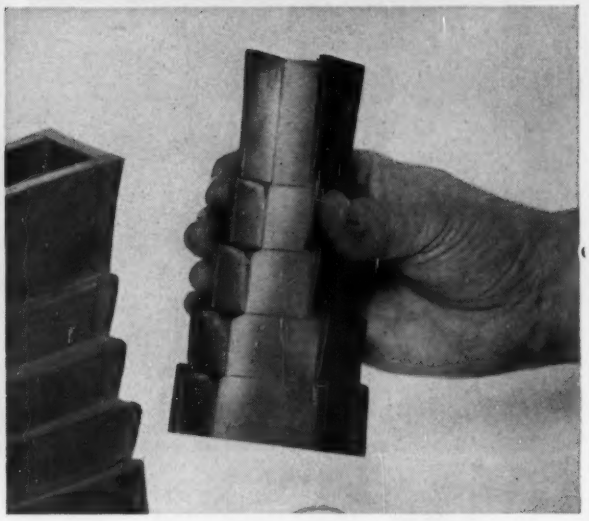
ARMALITE CO. LTD., TORONTO, CANADA
L. VAN DER HOORN, UTRECHT, HOLLAND
ROBERT BRYCE & CO. LTD., MELBOURNE, AUSTRALIA

And many Agents throughout the world





In electrotyping, plating rotogravure rolls, electroforming, "Plus-4" Copper Anodes cut plating costs

ELECTROTYPERS have discovered that, in addition to eliminating the use of bags and diaphragms, they can place "Plus-4" (Phosphorized Copper) Anodes closer to the cathodes to speed up the plating cycle 30% or more with the same power input – and still obtain a smooth deposit. As an alternate, power can be reduced by one-third with an equal reduction in resistance and generation of heat to obtain finished electros in the same plating time. This is an important advantage when thermoplastic plates or molds are used and tanks must run no higher than 95F.

MAKERS OF ROTOGRAVURE ROLLS have found that "Plus-4" Anodes provide a much finer, smoother surface for polishing and etching, and retain the quality of the light tones in runs of over one million impressions on a single set of design cylinders.

In addition, they report significant reductions in cost. One publisher found that he produces superior rolls with less labor and a reduction of 18 to 20% for materials required in the plating process. Another reports he gets a dividend of eight extra rolls for each tank load of "Plus-4" Anodes. And still another has found a 15% saving in over-all costs.

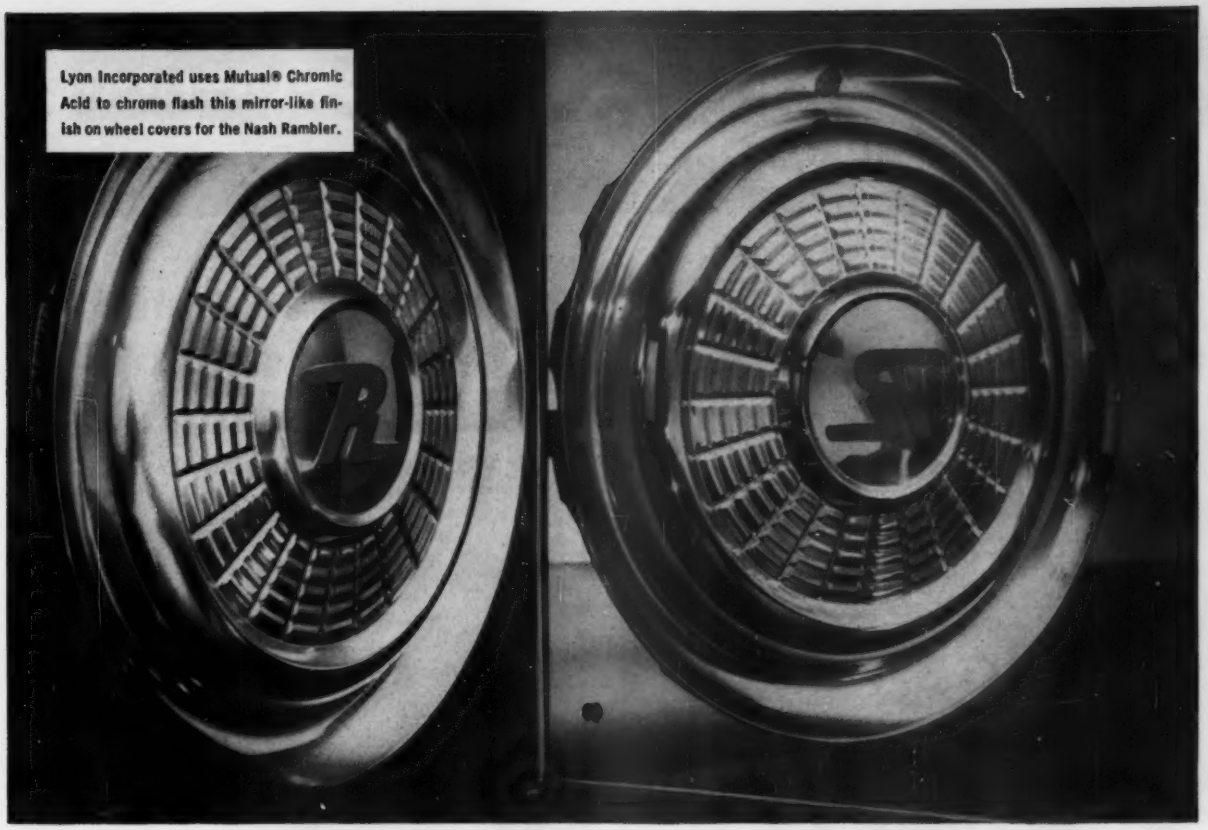
IN ELECTROFORMING operations, "Plus-4" Anodes – by eliminating the most prevalent acid-copper plating difficulties – have made it practical to produce many new products. Their ability to provide a smooth, dense deposit relatively free from growths and blemishes made possible relatively thick shells for molds used in making rubber and plastic articles, and in intricate precision parts for electronic use. Electroformers report operating economies similar to those found in the graphic arts field.

WRITE FOR INFORMATION on how you can obtain a test quantity to supply one tank. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass, Ltd., New Toronto, Toronto 14, Ontario. 60106

ANACONDA®

"PLUS-4"® ANODES Phosphorized Copper

Made by The American Brass Company



Lyon Incorporated uses Mutual® Chromic Acid to chrome flash this mirror-like finish on wheel covers for the Nash Rambler.

MIRROR FINISH OVER STAINLESS!

Chrome flashed by skilled plater using MUTUAL CHROMIC ACID

Experienced platers, like Lyon Incorporated, rely on high purity Mutual Chromic Acid to produce chrome plate that's decorative and durable. Combining careful control and plating skill with Mutual Chromic Acid, Lyon produces a mirror-like finish on wheel covers for the Nash Rambler. The plating is done over 301 Stainless Steel in a bath of slightly lower acid-sulfate ratio than that used for chrome plating over nickel.

Mutual Chromic Acid is always 99.75% pure—or better. Its low sulfate content (less than 0.1%) makes it easy for you to control the acid-sulfate ratio of your plating bath. This safeguards against plating difficulties—and expensive rejects!

For technical information about Mutual Chromic Acid, send coupon for our free booklet, "Chromium Chemicals." Our Technical Service Staff will also be happy to answer your questions.

OTHER PRODUCTS FOR PLATERS

SOLVAY® Ammonium Bicarbonate • SOLVAY Caustic Soda
SOLVAY Hydrogen Peroxide • SOLVAY Methylene Chloride

Allied Chemical

SOLVAY PROCESS DIVISION
61 Broadway, New York 6, N. Y.

MUTUAL chromium chemicals are available through dealers and SOLVAY branch offices located in major centers from coast to coast.

SOLVAY PROCESS DIVISION 44-60
Allied Chemical Corporation
61 Broadway, New York 6, N. Y.

☐ Send Bulletin 52 "Chromium Chemicals"
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electroplating at your plant... methods... dependable service

Two convenient forms of sodium cyanide 97%

ALL-PURPOSE CYANOBRIK®

—handy, pillow-shaped briquettes of 97% minimum sodium cyanide for all applications: plating, case hardening and chemical manufacture. Cuts inventory and purchasing problems. Made by a new Du Pont process, the briquettes are lower in moisture content and are more moisture-resistant than before.

CYANOGRAN® M

—granular, easily dissolved form of 97% minimum sodium cyanide. Ideal for dry compounding where uniformity of size is desired. "Cyanogran" M will pass through a 10 mesh screen; is retained on a 50 mesh screen. Absence of fines and dusting makes it easy to handle. It sells at the same low price as All-Purpose "Cyanobrik".

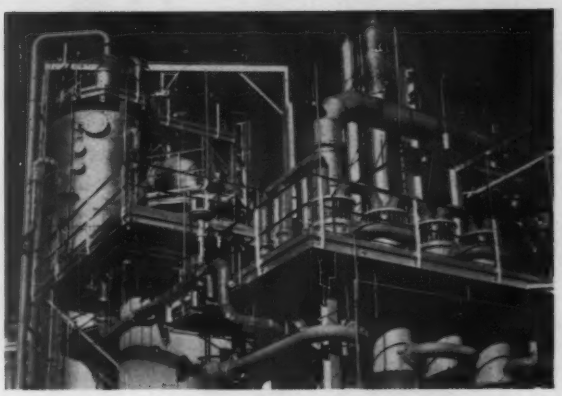
Du Pont sodium cyanides are highly suitable for cyanide electroplating solutions, including copper, brass, zinc and cadmium normally using sodium cyanide. Negligible sulfide content makes them especially attractive for use in sulfide-sensitive, bright copper baths. Specifications:

(NaCN-97% min.; NaCl-0.2% max.; Sulfides as S-0.0005% max.)

POTASSIUM CYANIDE

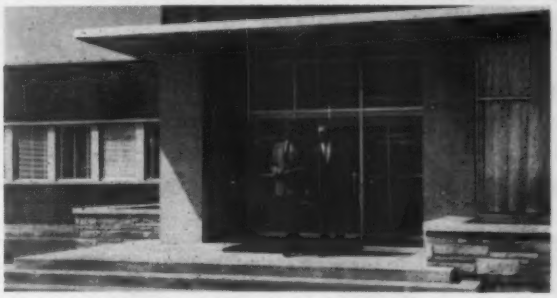
The extremely low sulfide content and high assay of Du Pont potassium cyanide make it ideal for all plating solutions in which potassium cyanide is specified. It is particularly suitable for use in modern bright cyanide copper, gold and silver plating baths. Specifications:

(KCN-98% min.; KCl-0.5% max.; Sulfides as S-0.0003% max.)



New modern plant assures reliable domestic source of supply

Centrally located in Memphis, Tenn., Du Pont's new chemical plant (above) is producing the high-quality sodium and potassium cyanides mentioned at left. This new source of supply means that you can depend on Du Pont to meet your needs quickly . . . at all times.



Technical service for you

Du Pont's nationwide staff of technical field men is ready to assist you whenever you ask for help. They're backed by a 2-million-dollar Sales Technical Laboratory in Wilmington, Delaware. All lab facilities are at your disposal. For more information on Du Pont electroplating chemicals and timesaving processes, call your nearest Du Pont representative (see below).

E. I. DU PONT DE NEMOURS & CO. (INC.)
ELECTROCHEMICALS DEPT.,
SODIUM PRODUCTS DIVISION
WILMINGTON 98, DELAWARE

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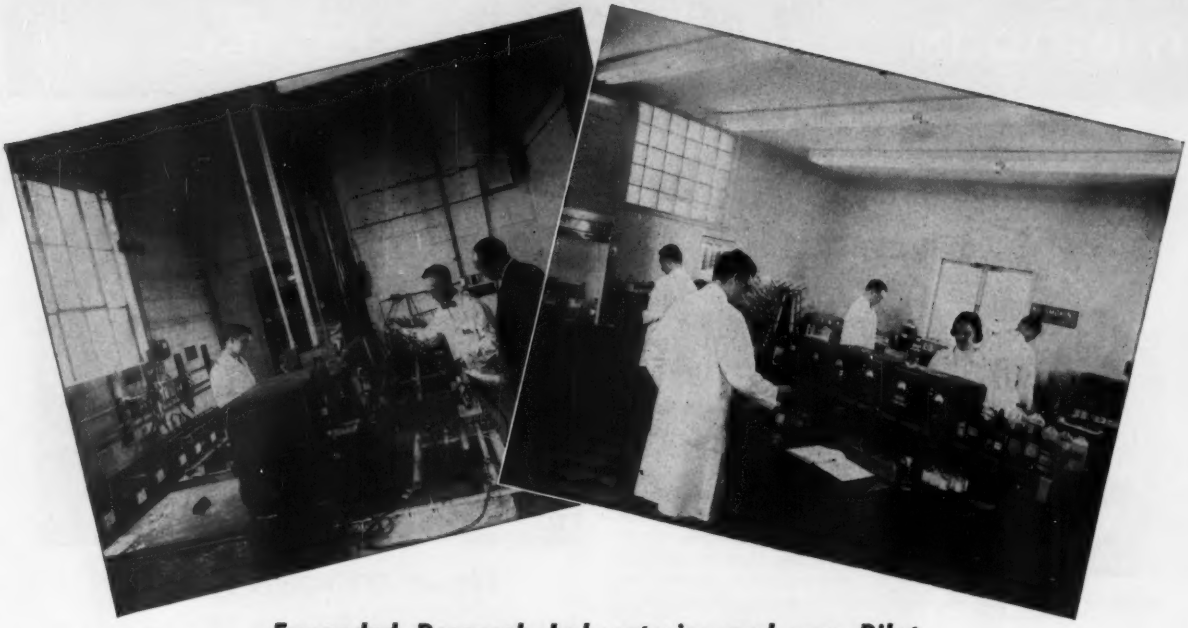
... THROUGH CHEMISTRY

BREAKING BARRIERS IN PLATING



Expanded Research Laboratories and new Pilot Plating Plant produces better ROHCO® products TODAY . . . while planning for TOMORROW.

It's often a long road from customer to supplier. To shorten the distance, the above are views of the new splendidly equipped research laboratory and pilot plating plant recently added to ROHCO's already well equipped facilities. Here, present plating methods are improved and new ideas and discoveries are tried and developed.

ROHCO's special techniques of plating control have made its services a trusted source of help to platers everywhere. Your customers, too, will appreciate the ROHCO upgrade of their metal finishes — for zinc, cadmium, chromium and aluminum. And remember, ROHCO offers a complete line of equipment and chemicals for all your plating needs!

ROHCO

Nationwide Stockpoints

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The RIGHT START . . . a BETTER FINISH

Wyandotte's amazing new development for steel electrocleaning!

Never before an electrocleaner like this! New MAXAMP delivers a new high in performance; brings you outstanding efficiencies never before possible.

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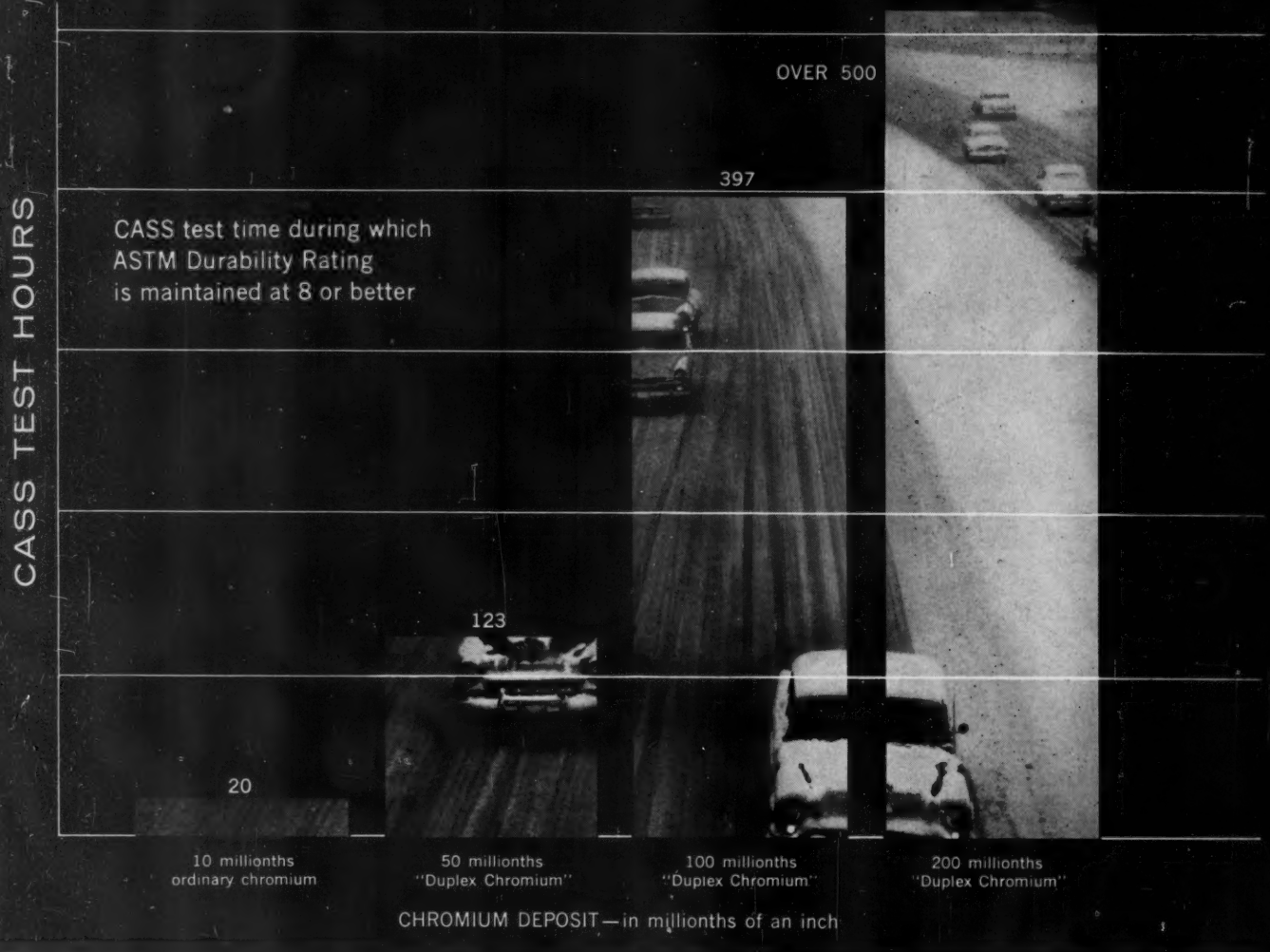
So, if you're interested in more efficient electrocleaning operations—and who isn't?—it'll pay you to investigate MAXAMP. It's the "new king of steel electrocleaners!" Call your Wyandotte representative for a demonstration, today! *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

Wyandotte CHEMICALS

J. B. FORD DIVISION

THE BEST IN CHEMICAL PRODUCTS FOR METAL FINISHING



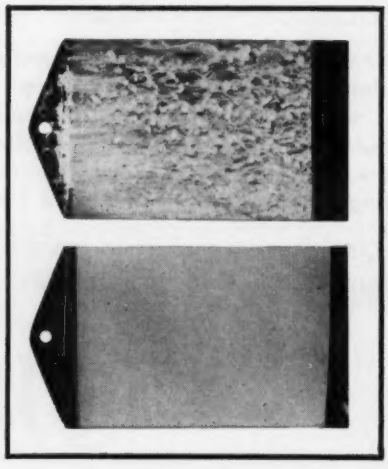
The thicker the "Duplex Chromium" ...the longer the plating lasts

RESULTS with M&T "DUPLEX CHROMIUM" plated over a suitable nickel undercoat confirm that there's a dramatic improvement in durability with 50 millionths of an inch of "DUPLEX CHROMIUM." With 100 millionths it's even better . . . and with 200 millionths, you have the finish of the future.

The graph shows this clearly. These are results with zinc die castings plated with identical undercoats but different chromium topcoats. *Corrodkote* corrosion tests show the same pattern.

Experience shows that the only suitable way to plate thicker decorative chromium is with Unichrome SRHS® solutions. They make possible the correct *type* of deposit. They save production time. They simplify operations. With a combination of two of these baths you produce M&T "DUPLEX CHROMIUM." Unichrome Crack-Free Chromium comes first, to block infiltration of corrosives. *Giving more uniform plate distribution,* this bath deposits ample thickness in recesses, with minimum burning on edges. A deposit of special Unichrome SRHS® Chromium then follows, to minimize localized corrosion at defects in the basis metal.

Send for an M&T plating engineer, or for literature.



Zinc die cast panels after 272 hours CASS test. Both had same copper and dual nickel undercoats. Top panel, plated with 0.01 mil ordinary chromium gets ASTM rating of 0. Bottom panel, plated with 0.10 mil "DUPLEX CHROMIUM" still rates a perfect 10.

plating products

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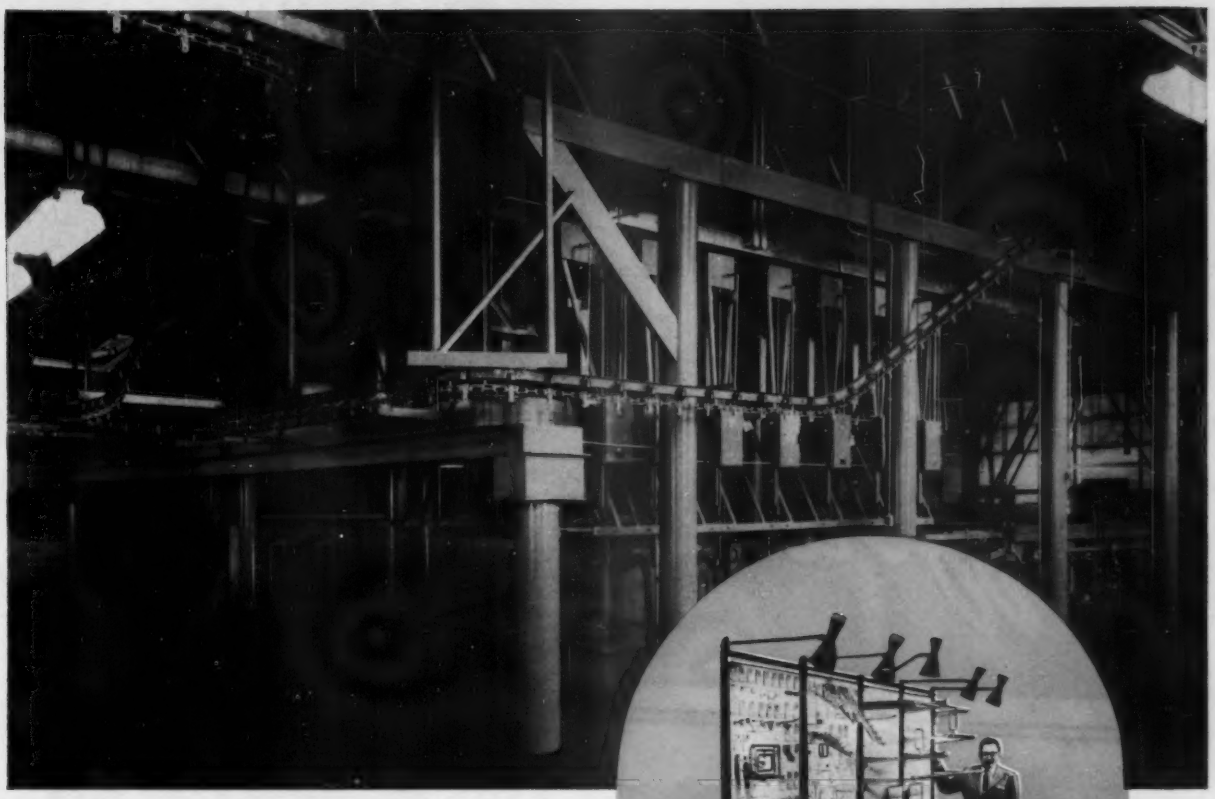
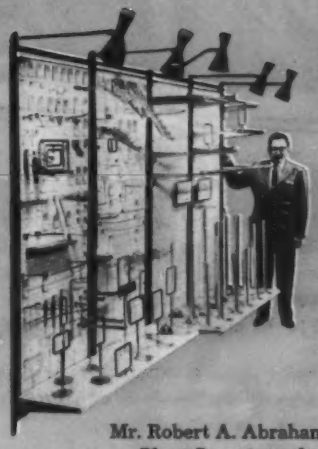
General Offices: Rahway, New Jersey
In Canada: Metal & Thermit — United Chromium of Canada, Limited, Rexdale, Ont.



how CROWN "MP" increased production and efficiency at REFLECTOR HARDWARE*

The Crown "M-P" is the most versatile automatic processing machine to be found. It is not unusual for several dissimilar jobs to be in process simultaneously . . . for example, two or three different metals can be plated in racks or barrels at two different voltages. The "M-P" handles an astonishing range of sizes and weights . . . parts from ¼-inch to 40-feet; from fractions of an ounce to 1½-tons can be processed at each station. The machine illustrated processes over 5000 *different items.* The key to "M-P versatility is a control system far in advance of any similar equipment. If you have a continuous dipping process, find out what Crown automation can do for you . . . write for Bulletin "M-P" today!



Mr. Robert A. Abrahamson,
Plant Superintendent
REFLECTOR HARDWARE CORPORATION

says: "With modern automation of our nickel, chrome and cadmium processing, we are able to monitor production to keep up with our tight delivery schedule. The Crown "M-P" has also improved quality, speeded production and cut costs . . . it all adds up to a general efficiency gain that makes this machine a very profitable investment."

*WORLD'S LARGEST MANUFACTURER OF METAL MERCHANDISING EQUIPMENT

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The New STUTZ Plating Barrels

Low headroom design

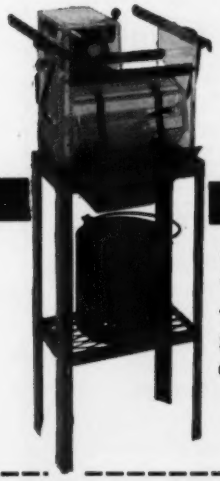
New materials

Stutz complete cycle assembly for operation in tanks with driving mechanism located externally. Lifting and lowering of unit reduced to a minimum. Cylinder is totally submerged in operation. Belt drive is positive timing design and belts can be changed if necessary in seconds without tools. Saddle horns are located on 15" centers. Cathode contactors dangler type standard, other types available. Cylinder hangers are cast steel protected with special hard rubber or fused vinyl chloride.

- Cylinders can be supplied in special sizes, partitions if necessary and special cathode contactors as required.
- Barrel assembly units are made to fit all makes of tanks.

. . . PLEXIGLAS • POLYPROPYLENE • TEMPRON • MELAMINE . . .

Cylinder rotation in this design is provided by motor drive mounted directly in super structure bridge member. Total weight and overall height has been greatly reduced. Handling therefore is fast and smooth. Cylinder transported from one operation to the next under continuous rotation. In this manner solution dragout is reduced to a minimum. Rinsing time following alkali cleaning, acid pickling, etc., is greatly reduced. Overall dimensions of tanks is lessened by the elimination of motor drive platform. Electric service 440, 220, or 115 volt with grounded cable and Hubble-lock heavy duty safety connector.



Sizes 12" to 18" inside diameter—24" to 42" long — perforations 3/32" standard. All other sizes available.

Tanks in single and multiple — Power equipment — dryers — filters — heat exchangers — chemicals — anodes — ventilation, etc.

Also Adaptable for Tanks Other Than Ours.

STUTZ *Portable Plating Barrels*

The Stutz Portable Barrel is made in 3 standard sizes with cylinders having inside dimensions of 6"x12", 8"x18" and 10"x20" I.D. Smaller upon application. Standard openings are 3/32". Smaller or larger openings can be furnished as required.

- **Baskets in perforated metals or wire mesh.**
- **Load/Unload Stand for convenient and fast handling of work load.**

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The STUTZ Company

We Invite your Inquiries

4430 West Carroll Ave. Chicago 24, Ill.

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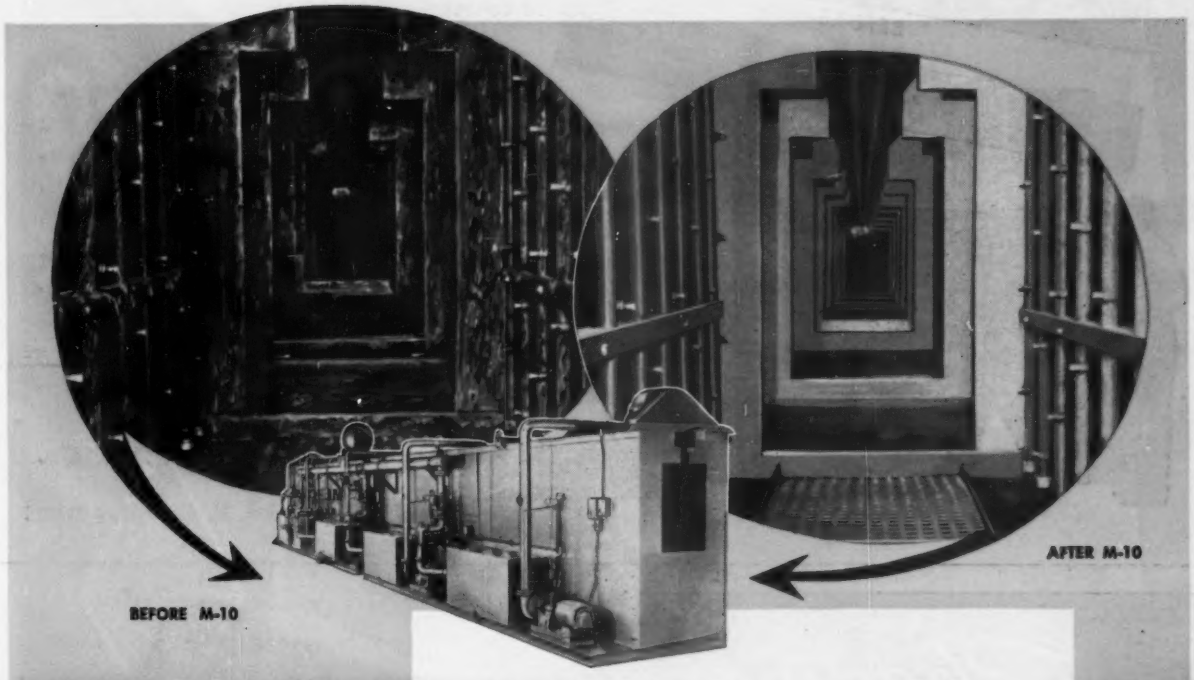
DETREX M-10

Miracle Phosphate Scale & Sludge Remover



- Prolong equipment life
- Eliminate acid damage to equipment
- Clean all "inaccessible parts"
- No dismantling of equipment necessary
- One material & operation — less labor
- No neutralizing necessary — just rinse

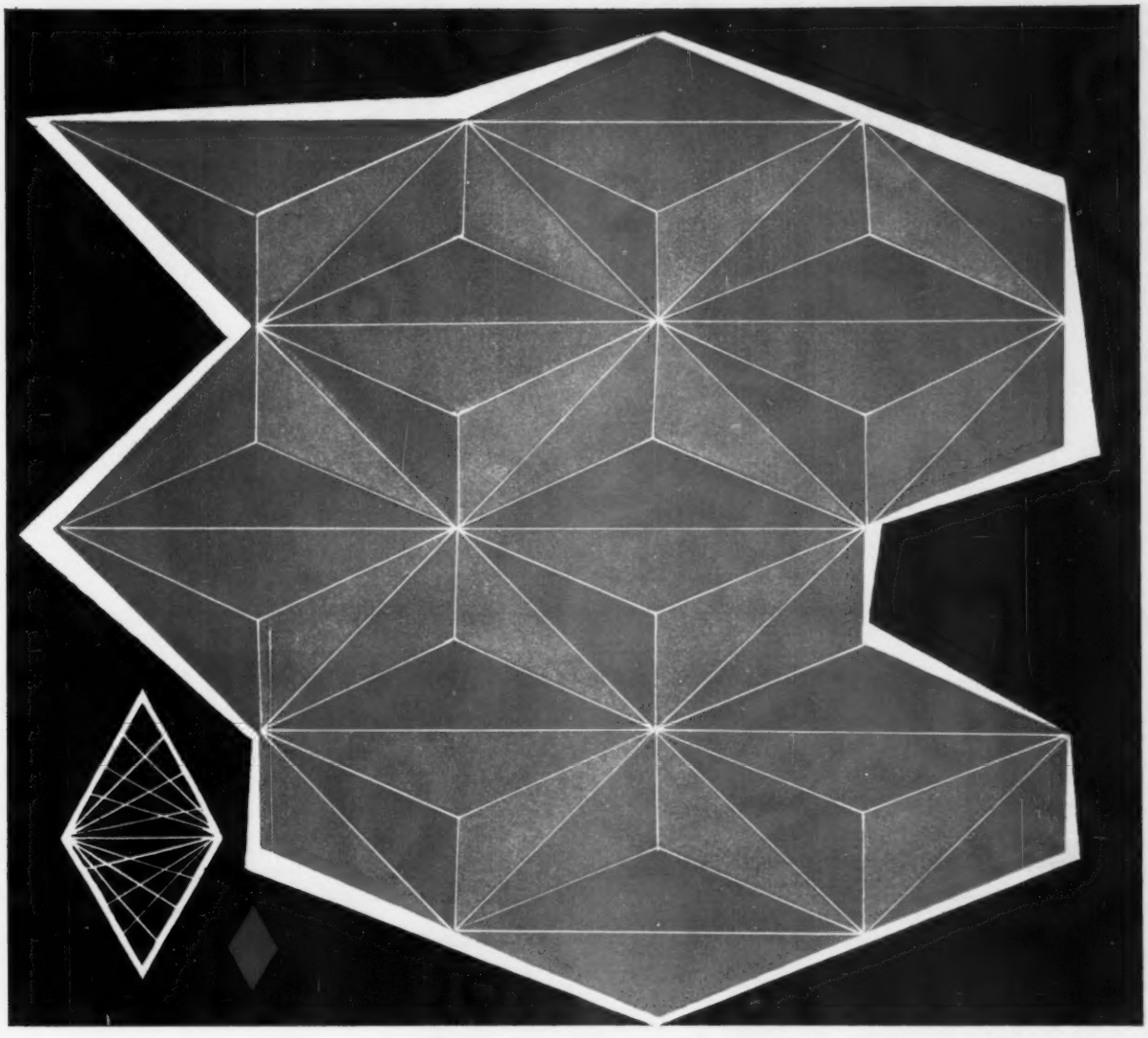
Here, at last, is the answer to the phosphate coating industry's maintenance problem. Phosphate scale, hard water scale and insoluble salts can be quickly removed from pipes—inside and out—and from walls and coils within the phosphate zone.

Detrex M-10, an alkaline cleaner, efficiently dissolves scale and sludge without damaging the equipment in any way. It may be used in immersion or spray equipment to greatly reduce the man-hours formerly required. With Detrex M-10 you completely eliminate the hazards inherent with the use of acid chemicals.

Send today for complete information on the new miracle phosphate scale and sludge remover — Detrex M-10.

DETREX CHEMICAL INDUSTRIES, INC.

Box 501, Dept.MF-660, Detroit 32, Michigan



For rich bronze and brown shades in color anodized aluminum . . .

COMBINE Aluminum Orange 3A and Aluminum Black V *. . . the all-around service Sandoz dyes.*

To match bronze and brown shades in color anodized aluminum, Sandoz formulas combining Aluminum Orange 3A and Aluminum Black V have demonstrated their dependability time after time. In the optical industry, for example, these dyes and the shades they produce are very popular for eyeglass frames. And among Aluminum extrusion processors they are first choice for decorative moldings. The reasons? They are stable in standing baths; they do not require critical pH adjustment; they are level dyeing; and they afford an adequate degree of light fastness for most applications.

Anything else you want to know about Sandoz dyes is immediately available by calling or writing;

SANDOZ

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Now Ready For Distribution

METALLIZING OF PLASTICS

by HAROLD NARCUS

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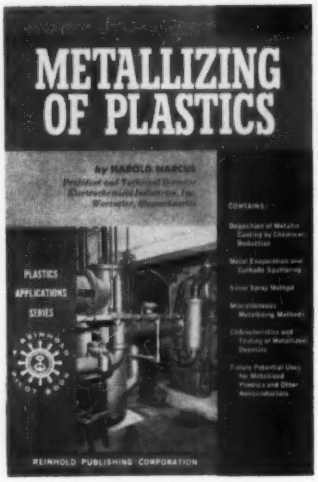
COVERS DETAILS OF EVERY COMMERCIAL PROCESS

THIS EAGERLY AWAITED BOOK presents complete details for carrying out every commercial metallizing process for plastics or other nonconductors. It is the first treatment of the subject that deals with *actual production procedures, formulations* and *techniques* for all known metallizing methods. These include the copper film process (developed by the author), the deposition of "electroless" nickel coatings, a review of the new molded conductive plastics, "gas" plating, the deposition of thick evaporated films and many, many others. The text is replete with illustrations showing the latest equipment being used in the newer processes. Recent advances receive special attention, particularly in the final chapter. This chapter contains developments as recent as a few months ago.



Much more than a bibliographic source, this book is essentially a metallizing manual for the plastics, electronics and electroplating industries.

CONTENTS

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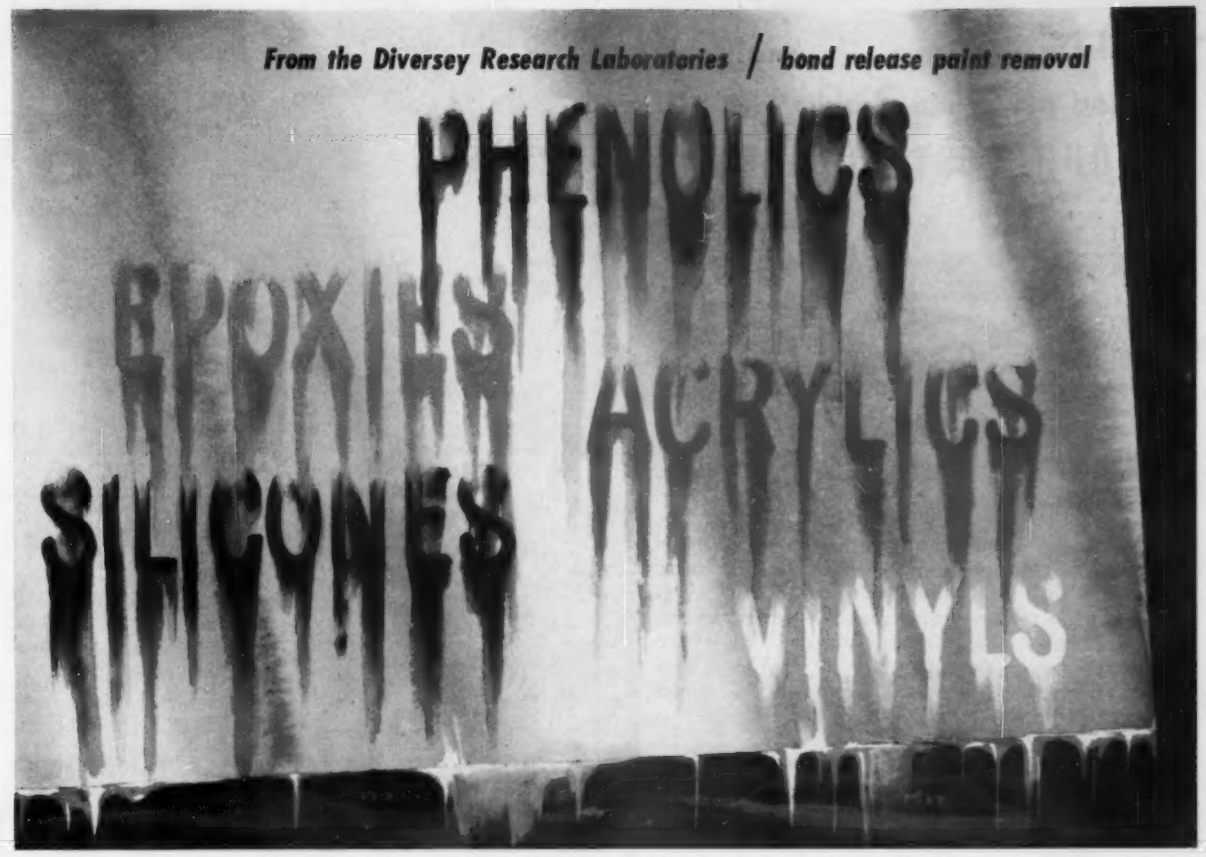

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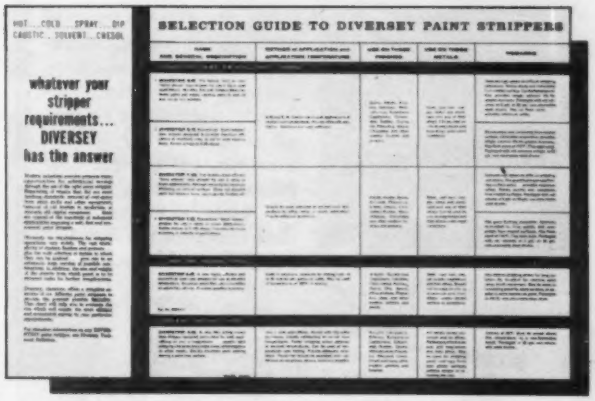

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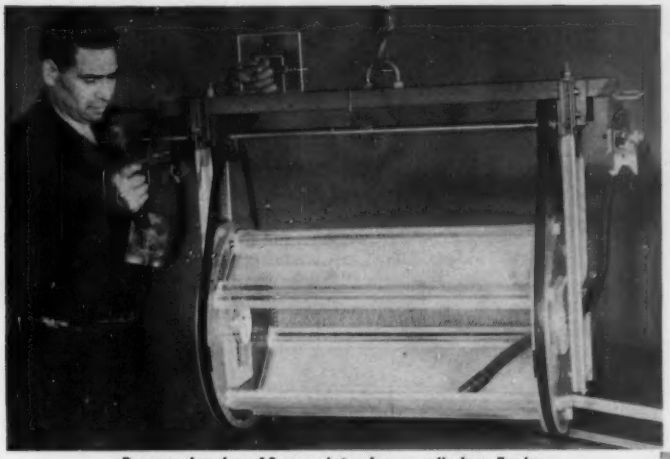

Remove danglers, 10 secs.; interchange cylinders, 5 mins.

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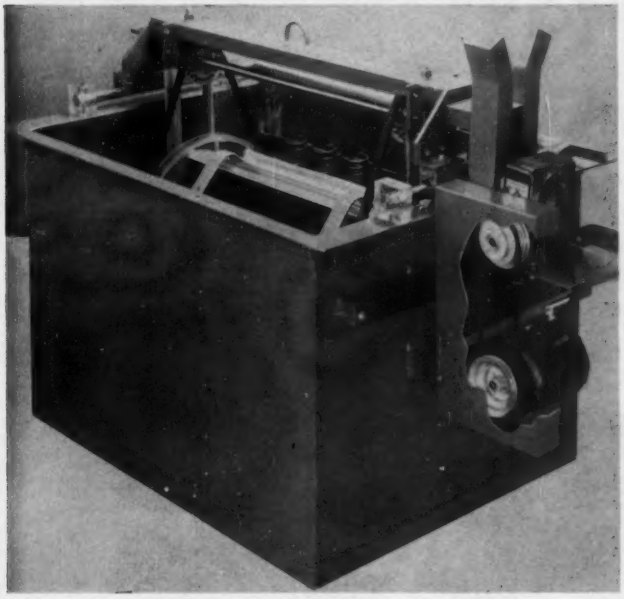
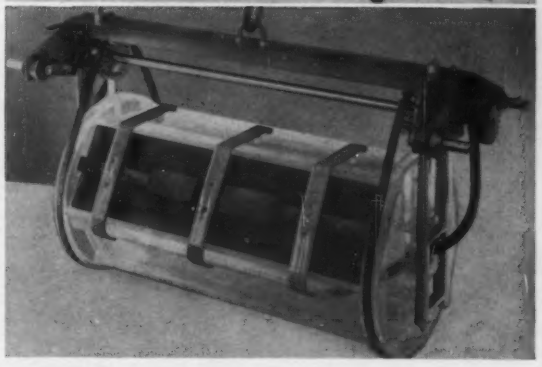
The One plating barrel with All the features

for unlimited, full-cycle performance required by today's metal finishing.



Cylinder fully submerged in solution. Note 3-speed drive-pulley and single screw adjustable motor mount.



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(lower right) G-S Cylinders and Superstructures to fit all makes installations (Inverted-V-Contacts, or horn-type)

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THE RIGHT SOLVENT FOR THOUSANDS OF INDUSTRIAL USES. Not only is Chlorothene NU recommended for cold-cleaning dip operations on the production line—it also cleans by spray, bucket or wipe methods. It's an all-purpose solvent for many applications, both on the production line and for maintenance use.

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ARIZONA
PHOENIX—Braun Chemical Company (C M P T)
PHOENIX—Western Chemical Company (C M P)
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WATERBURY—Hubbard Hall Chemical Company (M)

FLORIDA
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JACKSONVILLE—Amica Burnett Chemical Co. (C M P T)
MIAMI—Amica Burnett Chemical Co. (C M P T)
MIAMI—Biscayne Chemical Laboratories (C M P)
ORLANDO—Atlantic Chemicals, Inc. (C M P T)
TAMPA—Amica Burnett Chemical Co. (C M P T)
TAMPA—Atlantic Chemicals, Inc. (C M P T)
TAMPA—McKesson & Robbins, Inc. (C M P T)

GEORGIA
ATLANTA—Chapman Chemical Company (T)
ATLANTA—McKesson & Robbins, Inc. (C M P T)
ATLANTA—F. H. Ross & Company, Inc. (C M P)
ATLANTA—Southern States Chemical Co. (C M P T)
BIRMINGHAM—Chapman Chemical Company (T)
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SUMNER—Overton Chemical Sales (C)

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WICHITA—McKesson & Robbins, Inc. (C M)

KENTUCKY
LOUISVILLE—Dixie Solvents and Chemicals Co. (C M P)
LOUISVILLE—Gans Chemical and Supply Company (P)
LOUISVILLE—McKesson & Robbins, Inc. (C M P T)

LOUISIANA
BATON ROUGE—McKesson & Robbins, Inc. (C)
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NEW ORLEANS—Southern Solvents and Chemicals (C M P T)

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BALTIMORE—Tilley Chemical Company (T)

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BOSTON—Howe and French, Inc. (C M)
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NEBRASKA
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NEW JERSEY
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VINELAND—Lirio Chemical Company (C P T)

NEW MEXICO
ALBUQUERQUE—Braun Chemical Company (C M P T)
ALBUQUERQUE—Edmunds Chemical Company (C M P T)

NEW YORK
ALBANY—Krackler & Campbell, Inc. (M)
ATHENS—Spick Products Company (P T)
BINGHAMTON—Collier Chemicals, Inc. (P T)
BRONX—Elco Solvents Corporation (M P T)
BROOKLYN—Enequist Chemical Company (C P)
BUFFALO—Buffalo Solvents and Chemicals (C M P)
BUFFALO—Chemical Sales Corporation (C M P T)
BUFFALO—McKesson & Robbins, Inc. (C M P T)
GARDEN CITY—Hogan Industrial Supply Corp. (C M P T)
GLOVERSVILLE—Eastern Chemicals, Inc., S. H. Ireland Div. (C M)
KEARNY—American Chemicals, Inc. (C M P T)
LONG ISLAND CITY—Peerless Oil and Chemical Corp. (C M P T)
NEW YORK—American Chemicals, Inc. (C M P T)
NEW YORK—McKesson & Robbins, Inc. (C M P)
POUGHKEEPSIE—Duso Chemical Company (C)
RENSSELAER—Eastern Chemicals, Inc. (C M)
ROCHESTER—Chemical Sales Corporation (C M P T)
SYRACUSE—Eastern Chemicals, Inc. (C M)
UTICA—Monarch Laboratories (C M P)

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CHARLOTTE—Moreland Chemical Company (C M P T)
CHARLOTTE—Southern States Chemical Co. (C M P T)
GREENSBORO—F. H. Ross & Company, Inc. (C M)

OHIO
AKRON—Farley Solvents Company (C M P T)
AKRON—C. P. Hall Company (C M P T)
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CINCINNATI—Chipman Supply Company (T)
CINCINNATI—Herbert Chemical Company (P T)
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CLEVELAND—Man-Gill Chemical Company (C P T)
CLEVELAND—McKesson & Robbins, Inc. (C M P T)
CLEVELAND—National Solvents Corporation (C P T)
CLEVELAND—Ohio Solvents and Chemicals, Inc. (C M P)
CLEVELAND—R. W. Renton Company (C P T)
COLUMBUS—McKesson & Robbins, Inc. (C M P T)
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DAYTON—Ottoson Solvents, Inc. (T)
LIMA—Thomson Chemical Company (C M P T)
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TOLEDO—Toledo Solvents and Chemicals (C M P)
TOLEDO—M. I. Wilcox Company (C P T)
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OKLAHOMA CITY—McKesson & Robbins, Inc. (C M P T)
TULSA—McKesson & Robbins, Inc. (C M P T)
TULSA—Chemical Products, Inc. (C M P T)

OREGON
PORTLAND—Van Waters & Rogers, Inc. (C M P)

PENNSYLVANIA
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PHILADELPHIA—Alex C. Fergusson Company (C P T)
PHILADELPHIA—McKesson & Robbins, Inc. (C M P T)
PHILADELPHIA—Phillips and Jacobs, Inc. (C M)
PHILADELPHIA—Pioneer Salt Company (C M P T)
PHILADELPHIA—George Senn, Inc. (C M P T)
PITTSBURGH—Carmac Chemical Company, Inc. (C P)
PITTSBURGH—Carman-Pittsburgh Company, Inc. (C)
PITTSBURGH—Ft. Pitt Chemical Company (C)
PITTSBURGH—McKesson & Robbins, Inc. (C M P T)
READING—Textile Chemical Company (C P)
SCRANTON—Scranton Chemical Company (C P T)
YORK—Industrial Solvents and Chemicals Co. (C P T)

RHODE ISLAND
CRANSTON—Giffordline Chemical Company (C M P T)
PROVIDENCE—George Mann & Company, Inc. (C M P T)
PROVIDENCE—Sessions-Gifford Company, Inc. (C M P T)

SOUTH CAROLINA
CHARLESTON—Burris Chemical Company (C P T)
GREENVILLE—F. H. Ross & Company, Inc. (C M)
GREENVILLE—Southern States Chemical Co. (C M P T)
SPARTANBURG—Moreland Chemical Co., Inc. (C M P T)

TENNESSEE
CHATTANOOGA—Chapman Chemical Co. (C M P T)
CHATTANOOGA—Wilson Sales Company (C M P T)
KINGSPORT—Chem-I-Dent, Inc. (C P T)
MEMPHIS—Chapman Chemical Company (C M P T)
MEMPHIS—C. P. Hall Company (C M P T)
MEMPHIS—Ideal Chemical and Supply Co. (C M P T)
NASHVILLE—Chapman Chemical Company (C M P T)
NASHVILLE—Wilson Sales Company (C M P T)

TEXAS
AMARILLO—State Chemical Company (C M P T)
AUSTIN—R. M. Hughes Company, Inc. (C M P T)
BEAUMONT—Arthur Dooley and Son (C M P T)
CORPUS CHRISTI—McKesson & Robbins, Inc. (C M P T)
DALLAS—McKesson & Robbins, Inc. (C M P T)
DALLAS—Texas Solvents and Chemicals Co. (C)
DALLAS—Van Waters and Rogers, Inc. (C M P T)
EL PASO—Baron Chemical Company (C M P T)
EL PASO—Braun Chemical Company (C M P T)
EL PASO—Mine and Smelter Supply Company (P)
FORT WORTH—McKesson & Robbins, Inc. (C M P T)
HOUSTON—McKesson & Robbins, Inc. (C M P T)
HOUSTON—W. H. Curtin and Company (P)
HOUSTON—Dixie Chemical Company (C M P T)
HOUSTON—R. M. Hughes Company, Inc. (C M P T)
HOUSTON—Texas Solvents and Chemicals Co. (C M P)
HOUSTON—Van Waters and Rogers, Inc. (C M P T)
LUBBOCK—State Chemical Company (C M P T)
MIDLAND—State Chemical Company (C M P T)
ODESSA—McKesson & Robbins, Inc. (C M P T)
SAN ANTONIO—R. M. Hughes Company, Inc. (C M P T)
SAN ANTONIO—McKesson & Robbins, Inc. (C M P T)
TERMINAL—State Chemical Company (C M P T)

UTAH
SALT LAKE CITY—Braun-Knecht-Heimann Co. (C M P T)

VIRGINIA
RICHMOND—Phipps and Bird, Inc. (C M P T)
ROANOKE—Havnaer Supply Company (C M P T)

WASHINGTON
SEATTLE—Van Waters & Rogers, Inc. (C M P)
SPOKANE—Van Waters & Rogers, Inc. (C M P)

WEST VIRGINIA
BLUEFIELD—Fairmont Supply Co. (T)
CHARLESTON—B. Preiser Company, Inc. (C M P T)
FAIRMONT—Fairmont Supply Company (C P T)
HUNTINGTON—Cabell Chemical Company (C P T)

WISCONSIN
APPLETON—McKesson & Robbins, Inc. (C M P T)
CHIPPEWA FALLS—Lyon Chemicals Co., Inc. (C M P)
LA CROSSE—North Central Chemicals, Inc. (C M P T)
LA CROSSE—Wisconsin Solvents & Chemicals Corp. (C M P)
MADISON—North Central Chemicals, Inc. (C M P T)
MILWAUKEE—Benlo Industrial Chemicals Company (P T)
MILWAUKEE—McKesson & Robbins, Inc. (C M P T)
MILWAUKEE—Wisconsin Solvents & Chemicals Corp. (C M P)
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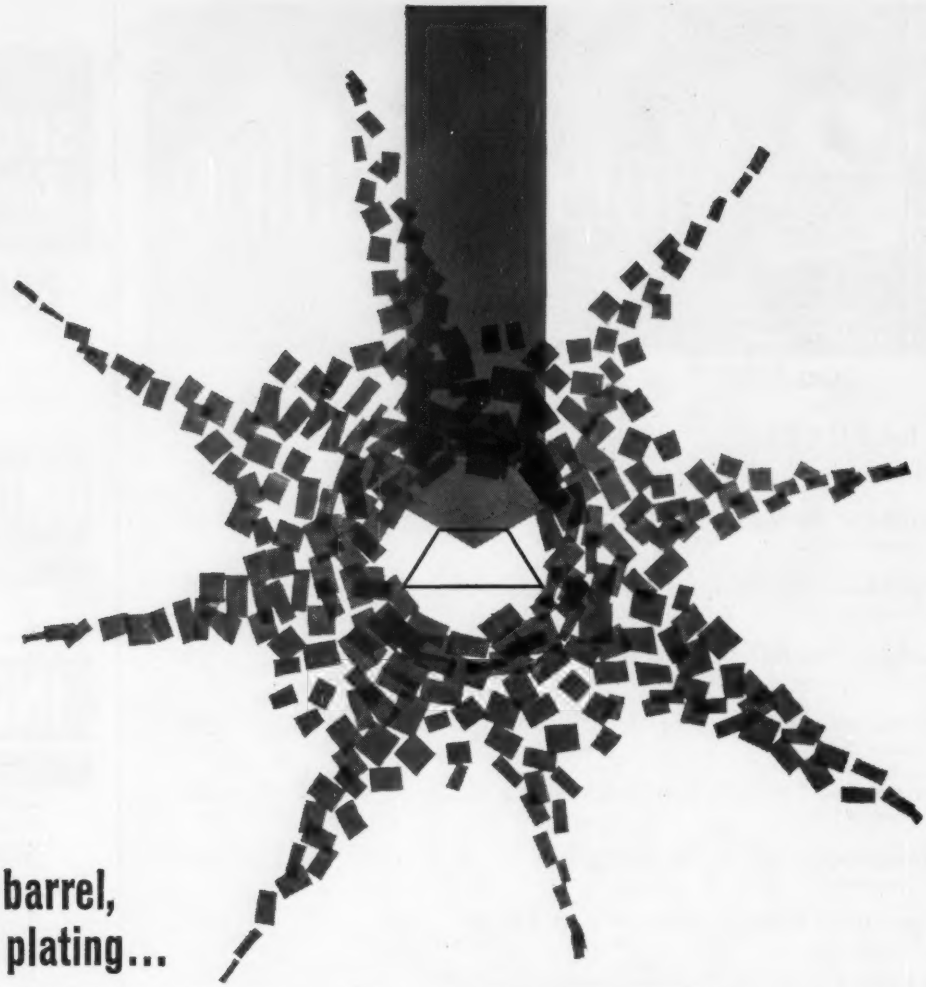

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BACKBONE

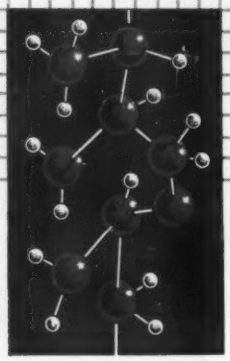
The *Oxford English Dictionary* defines the word "backbone" as a "main or important element — a mainstay." In searching for a suitable heading for the series of articles on synthetic resins that begins in this issue of METAL FINISHING we could think of no more appropriate title than one which embodied this word. The reason is that synthetic resins *are* the "main element," the "mainstay" or, in short, the *backbone* of modern finishes, whether they be paints, enamels, organosols, lacquers, or what-have-you.

Technology these days is advancing so rapidly that scientists are finding it more and more difficult to keep up with progress even within the realm of their own specialty. Competing products in the same field frequently have such similar properties that it becomes difficult to evaluate them. To digest the information that is available consumes so much valuable time that the literature search phase of research programs becomes quite burdensome. It is our hope that the new series of articles, "Synthetic Resins — The Backbone of Modern Finishes," will serve a twofold purpose: (1) To acquaint the man who has little more than a casual interest in the subject with the basic fundamentals of various resins; and (2) To provide the researcher with a guide to available types of resins in a given field.

The first article in this issue provides a general introduction to the subject. Subsequent articles will deal with silicone, melamine, urea, epoxy, styrene, urethane, polyamide, alkyd, vinyl, and other types of resins, as well as their copolymers. These resins form the foundation for modern finishes. Still newer resins, or improvements on existing ones, will be the basis of even better finishes to serve our expanding economy of the future, which, it has been predicted, will nearly double its capacity during the next fifteen years.

New types of finishes are constantly being demanded by manufacturers of everything from bobby pins to rocket engines. Fifteen years from now, a researcher will probably look back to 1960 in pity and wonder how those poor benighted souls ever managed to get along with the crude materials they had to work with. The resins we have today must form the building blocks for the polymers of tomorrow. It is our hope that by consolidating as much of the information currently available from manufacturers into a concise form, we can contribute our small part by pointing the way to tomorrow's wonderful world of coating resins.

Harold P. Preuss



SYNTHETIC RESINS

The Backbone of Modern Finishes

A SURVEY OF THE LATEST DEVELOPMENTS IN SYNTHETIC RESINS USED IN COATINGS

Part I - General Introduction

By Harold P. Preuss

Resins for Coatings Defined

IN his address presented at the 37th annual meeting of the Federation of Paint and Varnish Clubs in Atlantic City on October 22, 1959, General Joseph F. Battley, President of the National Paint, Varnish and Lacquer Association, emphasized that many paint formulations being sold today were unknown only three or four years ago. He went on to say, "In the next five years, another breakthrough is sure to occur from materials which are not yet out of the test tube. All the evidence is that the rate of change — discovery and development — is now being accelerated at an unbelievable pace."

These remarks are especially applicable to the synthetic resins which form so large a part of the composition of a coating. The reason is that the backbone of any coating is the resin that goes into its formulation, whether it be natural or synthetic.

Resins may be defined as high molecular weight organic compounds consisting of long polymer* chains. Resins are usually solids or semi-solids, usually transparent, non-crystalline, electrically nonconductive, and with definite melting points.

Lacquers generally consist of a solution of resins in appropriate solvents, and the resinous film is deposited when the solvent evaporates. Oil base paints usually contain lower molecular weight resin-forming materials which develop strength and polymer structure as a result of an oxidation process which takes place in the presence of air after deposition of the film. Of course, there are many substances which do not fit neatly into either of these classifications but form coherent films by a combination of solvent evaporation and polymerization. In some applications, the resin is used alone, without employing solvents or oils, curing being effected by catalysts or by heat.

In the series of articles which commences with this issue of METAL FINISHING, we will attempt to describe the particular function that each type of synthetic resin plays in contributing various properties to the finished coating. The field of synthetic resins is a constantly changing and expanding one. Therefore, in order to present the most up-to-date information that is available, we have contacted all of the leading resin manufacturers. As a result, these articles will represent the very latest thinking of those people who are at the forefront of scientific development in this field.

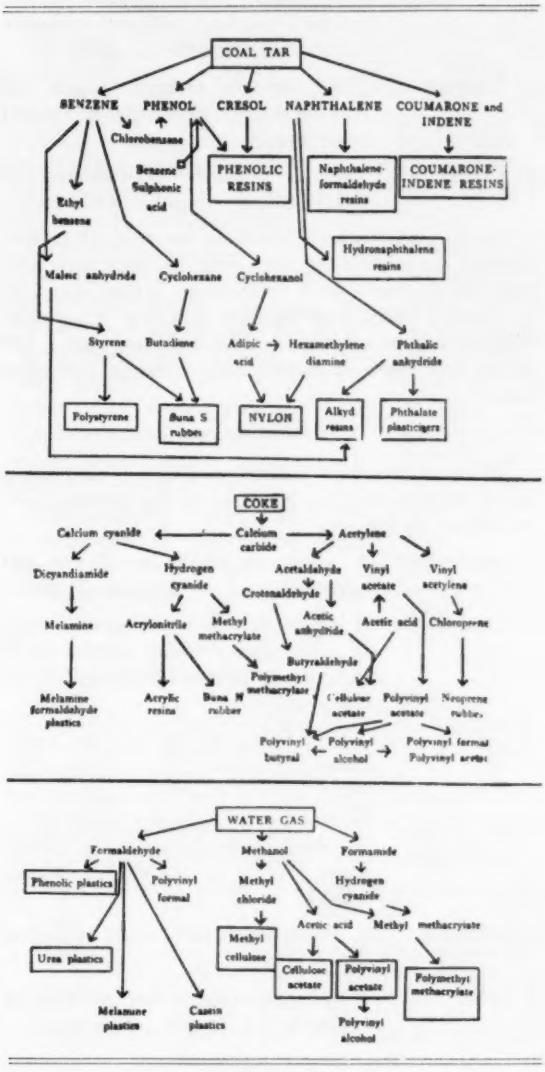
Classification and Usage of Synthetic Resins

The basic sources of synthetic resins are shown in Table I. Broadly speaking, synthetic resins used in coating materials may be divided into eight different classifications. Each of these classifications, of course, includes many members. We will attempt in this series of articles to identify each of the resins we discuss

*A polymer is a substance composed of giant molecules formed by the combination of a number of simple molecules with one another. The simple molecules are known as monomers and their union is called polymerization.

TABLE I

Sources of Synthetic Resins



with one of the classifications described:

Type	*Definition*
1. Hydrocarbon Resins	Resins which consist solely of the elements carbon (C) and hydrogen (H) polymerized usually at high temperature and pressure. An example is polyethylene (known in some overseas countries as polythene) which consists of polymerized ethylene $(C_2H_4)n$.
2. Chlorine or Fluorine Containing Polymeric Hydrocarbons	Resins having chlorine (Cl) or fluorine (F) substituted for the hydrogen atom to a varying extent. An example is polyvinyl chloride ($H_2C = C HCl$) which consists of a chlorine atom attached to the second carbon in the vinyl grouping ($H_2C = CH—$).
3. Hydroxyl Resins	These resins have the characteristic —OH group and are exemplified by the phenolic family of which phenol formaldehyde $(C_6H_4OHCH_2)_n$ is a basic member.
4. Resinous Products Containing Ether Groups	An ether is a chemical compound in which an oxygen atom is interposed between two carbon atoms in the molecular structure. An example is epoxy resin which is believed to have the repeating polymer unit structure of $—C_6H_4C(CH_3)_2C_6H_4OCH_2CHOHCH_2O—$.
5. Polymeric Esters	Esters are derived by an exchange of the replaceable hydrogen of an acid by an organic alkyl radical. They are equivalent to salts in inorganic chemistry. An example is polyvinyl acetate which is the polymerized form of vinyl acetate ($H_3C— COOCH = CH_2$) formed by the addition of acetic acid ($H_3C — COOH$) to acetylene ($HC = CH$).
6. Polyester Resins	These are produced by the esterification of polybasic organic acids with polyhydric alcohols. A familiar example is alkyds. A classical type of an alkyd resin can be made by the union of phthalic anhydride $[C_6H_4 (CO)_2O]$ with glycerine $[CH_3H_5(OH)_3]$.
7. Nitrogen Containing Resins	These comprise a wide family of resins all having nitrogen as a component. An example is polyurethane, one of the newest members of this group. It is formed by the reaction of diisocyanates, $(—NCO)_2$, with organic compounds having two or more active hydrogens (such as phenol, C_6H_5OH) under the influence of heat or catalysts.
8. Miscellaneous Resins	Under this heading we group all those resins we cannot place elsewhere, such as the silicones (which substitute silicon for carbon in their formulas) as well as the cyclic five carbon membered furan family of resins, etc.

The field of surface coatings is a very broad one and is generally considered to include any type of coating that is applied to any type of substrate. The coatings in which synthetic resins are used may be designed for any one of several functions. Some are decorative, others are preservative, and still others prevent corrosion.

Coatings which consist of a colloidal rather than

TABLE II

Total U.S. Production of Resin Materials for All Uses

Type of Resin	Dry Basis Thousands of Pounds 1958	1959	% Change from 1958
Alkyd	502,590	383,134	— 24
Cellulose	141,359	158,089	+ 12
Coumarone-Indene and Petroleum Resins	267,940	259,824	— 3
Epoxy	41,268	55,727	+ 35
Phenolic and Other Tar Acid	487,862	585,405	+ 20
Polyester	117,246	152,452	+ 30
Polyethylene	864,728	1,203,639	+ 39
Rosin Modifications	58,889	140,798	+139
Styrene	763,057	932,547	+ 22
Urea and Melamine	349,214	400,887	+ 14
Vinyl and Vinyl Copolymer	869,419	1,151,897	+ 32
Misc. Resin Materials, incl. silicones, acrylic, polyamide, etc.	195,415	244,430	+ 25
Total	4,658,987	5,836,918	+ 25

a true solution are known as "dispersion resins" and these, due to their larger particle size, do not penetrate fibrous materials as much as do other resins. They are frequently applied where surface irregularities are to be overcome.

Together with drying oils, resins comprise the bulk of film forming materials, or binders, in the surface coating field. Some resins are used by themselves as the principal binder in a coating, while other resins are combined with drying oils. Synthetic resins enjoy a wider use than natural resins because of their more consistent quality, the generally improved properties of the vehicles made with them, and the wide variety of unique qualities which they give to a surface coating. It is literally true that a finish may be individually tailored to a given use by selection of a given synthetic resin or combination of resins.

Formulation

While the formulation of protective coatings may be based on relatively simple principles, in practice it requires a considerable background of practical experience, skill, and theoretical knowledge. The basic purpose of a protective coating is to form a film over a substrate which will cohere to itself and adhere to the surface over which it is applied. The film-forming resins may be of a type (1) softened by heat, but which regain their original properties upon cooling (thermoplastic); or (2) not softened by heat as long as the temperature is not high enough to cause thermal decomposition (thermosetting).

Examples of thermoplastic film forming types of resins are the acrylics, acetates, butyrates, polyamides, vinyls, etc. Examples of thermosetting film forming resins include the epoxies, melamines, phenolics, polyesters, ureas, etc.

To modify their properties, various substances may be added to the basic resin. These substances include:

1. Plasticizers — Substances added to soften or otherwise modify the properties of the finished product without excessive sacrifice of strength and rigidity.
2. Pigments — These are used to convey color and may be organic or inorganic, natural or synthetic.
3. Extenders — These are primarily cost-reducing materials, usually of an inorganic type.

The uses of synthetic resins in the field of surface coatings are multiplying each year. Keeping pace with them are the methods of application. Airless spraying, two-headed resin and catalyst spraying equipment, fluidized bed techniques — these represent just a few of the new methods coming into common industrial usage.

Terminology

The synthetic resin industry makes use of a number of terms which, for purposes of clarification, may be defined as follows:

1. Accelerator — A substance which speeds up the polymerization of a synthetic resin.
2. Catalyst — A substance which changes the rate of a chemical reaction without itself undergoing permanent change in its composition.
3. Colloid — A very finely divided (but not molecular) dispersion of a solid in a liquid. Colloidal dispersions do not settle and the particles are too small to be observed by means of a microscope (except by the electron-microscope).
4. Inhibitor — A substance which slows down a chemical reaction.
5. Latex — Water suspension of fine particles of rubber or rubber-like polymers.

TABLE III

U.S. Production of Selected Resin Materials for Use in Coatings

Type of Coating Resin	Dry Basis Thousands of Pounds 1958	1959	% Change from 1958
Alkyd, phthalic anhydride and polybasic acid	486,863	359,823	—27
Phenolic, modified and unmodified, except by rosin	28,432	28,726	+ 1
Styrene, straight and modified	110,602	80,668	—27
Urea and Melamine, straight and modified	32,454	37,981	+17
Vinyl and Vinyl Copolymer (50% or more polyvinyl chloride)	*27,000	*31,500	+16

*Estimated

TABLE IV

Price Range on Some Typical Resins for Use in Finishes

Type of Resin	*Price Basis*	*Price Range*
Acrylic Copolymer Emulsions	Lb.	$0.21½-0.22
Acrylionitrile-Styrene Copolymer	Lb.	0.44 -1.00
Alkyd for High Grade Flat Finishes	Lb.	0.2065
Butadiene-Styrene Latices ... Dry	Lb.	0.29½-0.35
Epoxy Liquid Resin	Lb.	0.65 -0.78
Fluorocarbon Resin, Aqueous Dispersion	Lb.	5.15 8.00
Maleic Esters	Lb.	0.21 -0.27¼
Maleic Resin for Lacquers	Lb.	0.23½
Melamine-Formaldehyde Resin	Lb.	0.32¾-0.40
Nylon Resins	Lb.	1.18 -1.28
Phenolic Coating Resin	Lb.	0.30 -0.58
Polyamide Resin	Lb.	0.52 -0.90
Polyester Coating Resin Base	Lb.	0.36
Polyethylene, Low Molecular Weight Powder	Lb.	0.30 -0.37
Polystyrene Emulsions	Lb.	0.20
Saran Latex — Vinylidene Chloride — Acrylonitrile 52%	Lb.	0.45
Styrene Polymer, Natural, Clear	Lb.	0.40½-0.43½
Urea — Formaldehyde Resins	Lb.	0.20½-0.47¼
Vinyl Acetate Resin (Solution in Acetone)	Gal.	5.10
Vinyl Chloride Resins	Lb.	0.23½-0.46½
Vinyl Chloride-Acetate Resins	Lb.	0.23½-0.64

6. Organosol — Finely divided or colloidal dispersion of a resin in a plasticizer with solvents or other materials.
7. Plastisol — Colloidal dispersion of a resin in a plasticizer without solvent.

Identification of Synthetic Resins

Identification of synthetic resins in their finished form is usually exceedingly difficult. A person with a sensitive nose and some knowledge of the subject can identify some synthetic resins by holding a match to them. Care should be exercised, however, because cellulose nitrate is explosive when dry and in thin sections. If an electric soldering iron, applied before it gets red-hot to the resin surface, goes through the film, the resin is thermoplastic; if not, it is thermosetting.

If the edge of the flame of a bunsen burner is applied to a resin surface and the sample doesn't burn, it is a vinyl or fluoro-carbon (if it was found to be a thermoplastic resin) and probably a urea, melamine or phenolic (if it was found to be a thermosetting resin). A fishlike odor indicates a melamine type of resin, while a phenol odor indicates a phenolic type of resin. No odor should indicate urea. If the resin burns with a blue flame, that dies after removal, a polyamide is indicated. If the dying flame is yellow, the resin is thermoplastic, and if the odor is acrid, it is a vinyl. If there is an acetic acid odor, a flame-resistant cellulose acetate is indicated.

If a resin sample continued to burn after removal from the flame and was thermosetting, an alkyd type is to be suspected. An odor of burnt sugar indicates ethyl cellulose, while an odor of rancid butter indicates butyrate. A yellow flame and acetic odor indicates cellulose acetate or vinyl acetate. An odor of illuminating gas points to polystyrene.

Production and Cost

The increase in synthetic resin manufacture during recent years has been nothing short of phenomenal. A casual observation of Table II, showing total synthetic resin production figures for 1958 and 1959, will reveal this fact. Synthetic resin production for use in coatings is shown in Table III. We leave detailed interpretation up to the discretion of the more discerning of our readers. In 1959, total resin manufacture exceeded 5.8 billion pounds, an increase of 1.1 billion pounds over 1958, or 25%. Of course, not all synthetic resins find extensive use in the field of coatings. As a rough estimate, it may be said that approximately one-fifth of all resins manufactured are consumed as coating materials of one sort or another. The price range of typical resins used in organic finishes is shown in Table IV. In most cases, the 1960 price of these resins is lower than in any previous year.

Competition between various elements of the synthetic resins industry is spirited and relentless. Fortunately, there is room for everybody. Changing ways of life, changing technologies and changing times all contribute to new markets and new uses for both old and new products. Those manufacturers with vision and flexibility of action who can see beyond the immediate horizon are the ones who will flourish. Stagnation is dangerous to any company; in the field of synthetic resins, it is fatal. The keyword is RESEARCH and more RESEARCH. In our next article, we will tell how this RESEARCH has paid off in the development of one of the most remarkable family of synthetic resins of our times — the silicones.

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Thickness and Hardness Measurements On Gold Deposits

By Grace A. Wilson, *Laboratory Assistant, Sel-Rex Corp., Nutley, N. J.*

Miss Wilson had her public schooling in Jersey City, N. J., and upon graduation took evening courses in metallography and laboratory practice at Columbia University. Having worked previously in testing and research laboratories, she has been with Sel-Rex since 1956 in its analytical and metallurgical laboratories.

THE control of the thickness and hardness of precious metal electrodeposits has become increasingly important, due to the recent rapid growth of the precious metal plating industry in the area of engineering application. This interest is spilling over into the decorative field as well. Control of thickness and hardness requires methods of measurement of these quantities and it is important that those planning such measurements have an understanding of the methods themselves as well as the limitation of the various methods usually employed in industry.

While hardness determinations and microscopic measurements of very small dimensions are well known and widely described tools of the metallurgist and the metallographer, it has become apparent that the techniques used on solid metals and alloys cannot be applied to electrodeposits without certain modifications. It is the purpose of this paper to point out some of the limitations and to suggest caution in the interpretation of results.

Thickness Measurements

When preparing an electroplated specimen for a thickness measurement, a protective plate of nickel, copper, or silver is applied in order to preserve the sharp edges of the deposit under observation. The main object is to keep the metal surface as nearly optically flat as possible and avoid rounding of the edges.

A thickness measurement is made on a cross section. Should it be necessary to cut a section from a larger piece of material, care must be taken to make the cut exactly at right angles to the surface of the sample. Burrs caused by sawing should be removed, if possible, prior to mounting.

Mounting is done in either transoptic powder or Bakelite. With clear Lucite the technician has the advantage of seeing whether the sample remains in the vertical position or whether it leans to the diagonal. Bakelite on the other hand has a lower melting point, is somewhat harder, and is less easily attacked by etchants. A relatively new plastic material requiring neither heat nor pressure has made its appearance as a mounting material. Preliminary work did not meet our requirements but further experimentation is planned.

Grinding is carried out on a series of four water-cooled abrasive papers, beginning with #240 mesh followed by 320, 400, and 600 papers. Whether it is necessary to use the dry 3/0 and 4/0 emery papers before polishing on a suitably covered wheel is a matter of preference. Since the rounding of the edges of the metal is caused mainly during the polishing operation it is advantageous to limit the latter to as short a time as possible. It is our experience that the use of 3/0 and 4/0 papers will help accomplish this. The first, or #240 paper, should be employed until such burrs as remain from the saw are ground down. Before proceeding with each subsequent paper the technician should wash hands and sample with running water. The direction of grinding on a particular paper should be noted so that, when going to the next paper, scratches will be at right angles to those made previously, with the following reservations.

On occasions when two layers of relatively soft materials are to be observed, the recommended grinding procedure deviates slightly from the usual pattern. This would also hold true where there is an electrodeposit that cannot be protected by an outer plate. In such cases all grinding and polishing should be done in a longitudinal direction only, while exerting very light pressure. Where two layers of metal (one somewhat softer than the other) are under observation, this will eliminate, or at least retard, the diffusion or dragover of one layer of metal into the other. Where the electrodeposit is unprotected, rounding of the edges will be held to a minimum. The

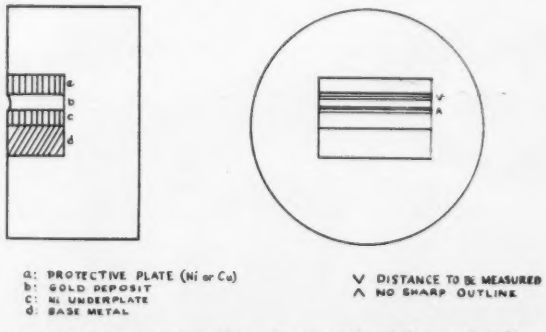

Fig. 1. Diagram showing effect of prolonged polishing and etching.

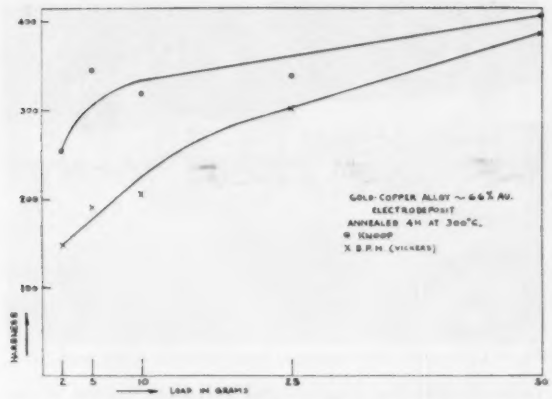

Fig. 2. Alloy gold deposit hardness. Curves for Knoop and diamond pyramid.

choice of a suitable covering for the polishing wheel, as well as the cutting medium, is largely determined by the necessity of obtaining whatever finish is required for solving a particular problem. The silk cloth is best suited for the attainment of an optically flat surface. In actual practice, however, it has been found that the cutting agent is thrown off too rapidly by centrifugal force, necessitating almost continuous recharging. With a fabric such as selvyt, particularly after it is well broken in, the compound is better held by the short nap and final polishing is more quickly accomplished. Rounded edges and some digging out of the softer metals between the metal layers is inevitable, regardless of the type cloth used. This difficulty can be reduced greatly if this step also is carried out on a flat cloth-covered platen, stroking again in the longitudinal direction.

A very light etch following the final polish will aid in visually separating the metals, making the important boundaries easier to measure. Ideally, the boundary lines would appear to be very fine hairlines, even when viewed under the highest magnification. Fig. 1 shows diagramatically, in exaggerated form, the effect of prolonged polishing and etching. Even under the most careful treatment it is rarely possible to have the entire cross section in one optical plane, and this becomes increasingly troublesome under the high magnifications of the order of 625X and higher which have to be used for thin deposits. It becomes very difficult to see (much less measure to any degree of accuracy) deposits of less than one micron (0.00004″). On a deposit of supposedly 0.00004″, three different observers reported 5, 6, and 8 units of the filar micrometer drum, on the same spot respectively, which would result in actual thicknesses of 0.000042″ to 0.000064″, or an error of 50%.

Hardness

As a rule, deposits of gold and other precious metals are rarely heavier than 0.0001″, and any hardness measurements made on the surface are apt to be influenced by the basis metal. Surface measurements on gold deposits of increasing thickness (from 30 to 50 microns) have been reported whereby the hardness decreased as the gold thickness increased. Obviously, for the thinner deposits the harder basis metal falsified the results. An accepted rule is to have the indentor penetrate to a depth of 10% or less of the thickness of the deposit in order to eliminate the influence of the basis metal. In most cases, therefore, only lighter loads can be applied. An exception to the rule would be in cases where the deposited metal is of approximately the same hardness as the basis metal, when a depth up to 30% of the thickness may be permissible. But here also high stress or brittleness of the deposit could lead to errors.

If measurements are made on the surface, the use of the diamond pyramid is preferable because it may give a better average reading on a group of columnar crystals usually oriented perpendicular to the surface.

A disadvantage of a surface measurement is the often grainy texture prevalent in an electroplate of any appreciable thickness. This makes it difficult to achieve a sharply outlined indentation. And again, a polish no matter how light, would not only reduce the thickness but, at the same time, create a disturbed layer with a possible work-hardening effect which would make any conclusions as to hardness almost useless. The Knoop indentor, being of rhomboid design and very elongated, is chosen primarily for cross section measurements, where lack of sufficient thickness does not allow the use of the diamond pyramid. Regardless of whether the use of the diamond pyramid or the Knoop indentor is dictated by the individual conditions, it should be remembered that the penetration depth of the Knoop indentor under the same load is one-thirteenth of the longer diagonal, measured in microns, as against one-seventh on the diamond pyramid.

Some exploratory work carried out on cross-sections of electrodeposited material proved that the confining metals are the only hindrance to the selection of the load. It is important that the indentation does not touch the confining metals. In fact, sufficient material should be left on either side in order to obtain uninfluenced readings.

The preparation of a cross-sectioned sample for hardness measurement should be the same as that of the material prepared for thickness determination. After polishing on the wheel, an etch recommended for the particular metal under observation should be em-

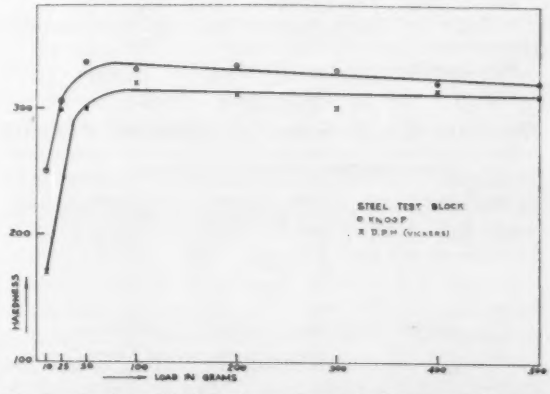

Fig. 3. Steel test block hardness. Curves for Knoop and Diamond pyramid.

ployed. This should be extremely light, the sole purpose being the removal of the amorphous layer, produced by the various preparatory operations. A quick polish on the cloth will impart a smooth enough surface on which the indentor outline is sharp and easily discernible. It has been established that, at light loads, the hardness is not independent of the load and does not follow Kick's law:

$$\left(H = \frac{\text{Load}}{\text{Area of Indent}}\right)$$

. It was found that the hardness increased with increasing loads up to a point where it leveled off. This was the case with both diamond pyramid and Knoop indentors. Believing this might be a peculiarity of an electrodeposit, tests were conducted on alloy gold deposits and on a test block of steel which is supplied by the manufacturers of the hardness tester. The graphs in Figs. 2 and 3 show the deviations. Table 1 shows the same effect for a fine gold deposit and a sheet of cold-rolled fine gold. When making hardness tests it is not advisable to base a figure on one indentation alone. Several indentations made a few microns apart, using the same load, will give a good average. Should one indentation appear much larger than the others, vibration or jarring might be responsible. This reading should be eliminated and a substitute made. If, when using the diamond pyramid, one diagonal measurement differs radically from the other, an occurrence such as shown in Fig. 4 might be suspected. An etching reagent applied after the impression was made substantiated the suspicion of collapse on a grain boundary. It is well to disregard such a measurement. Where applicable, the load should be increased until a point is reached where the hardness numbers level off. Actually, from the definition

$$H = \frac{\text{Load}}{\text{Area of Indent}} \text{ or } H = \frac{P}{d^2}$$

the hardness should be independent of the load.

This equation holds true in the macro range and, thus, the hardness becomes a material constant. Recent work done by A. Braun* introduces physical properties such as elastic recovery, plasticity, and

*A. Braun, communication presented before Societe Francaise de Metallurgie, Paris, Oct. 1957.

Also several papers by same author in reports of the Swiss Research Laboratories of the Watch Industries, Neuchatel.

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Metalloberflache #7, Page 102-106, 1952.

TABLE I

Hardness Measurements — Diamond Pyramid

HARDNESS MEASUREMENTS ON BRIGHT GOLD DEPOSITS

LOAD	2 GRAMS			4 GRS.			5 GRS.			10 GRS.			25 GRS			50 GRS			100 GRS		
	F.U.*	U**	DPH	F.U.	U.	DPH	F.U.	U.	DPH	F.U.	U.	DPH	F.U.	U.	DPH	F.U.	U.	DPH	F.U.	U.	DPH
	37	7.74	61.8	49	10.3	71	50.5	10.6	82.5	70	14.6	67	99.5	20.8	107	138.5	29	110	201	42	106
	37.5	7.8	60.4	55.5	11.6	69	53	11.1	75	73.5	15.4	78	101	21.1	104	140	31	95			
	50	10.5	33.6				56	11.6	70												
							58	11.7	67												

HARDNESS MEASUREMENTS ON FINE GOLD SHEET (COLD ROLLED)

LOAD	1 GRAM			5 GRS.			10 GRS.			25 GRS.			50 GRS.			100 GRS.		
	38.2	8.0	29	73.1	15.3	40	88.4	18.5	54	127	26.6	65	182	37	68	242	50.7	72

X FILAR UNITS ON MICROMETER DRUM

XX MICRON

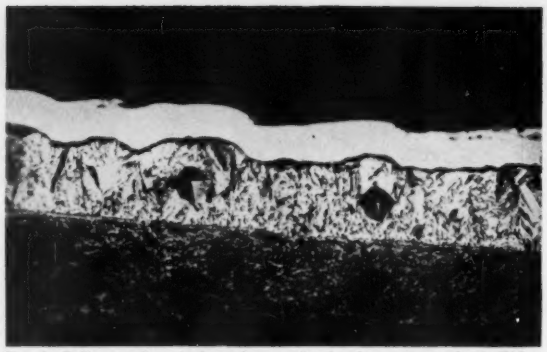

Fig. 4. Collapse of grain boundary under hardness tester load. 510x.

viscosity into the fundamental equation. In the range of microhardness, Kick's law is no longer valid and is replaced by the equation

$$H = \frac{P}{d^n}$$

where n is usually smaller than 2. Extensive studies made on precious metal deposits have shown that the hardness numbers obtained cannot be taken as material constants. To the above considerations we must add that the rate of descent of the indentor must be taken into account, especially with light loads where the impact of a hastily applied load could influence the indentation to an erroneous depth. Wherever permissible, the heaviest load possible and a magnification that will give the highest possible number of units on the filar micrometer drum should be used.

Referring back to the irregularities pointed out previously, it would seem advisable not to assign definite hardness numbers to the various gold deposits, because tests made by different observers under different conditions did not give comparable results. It is suggested, therefore, that hardness measurements on various gold deposits should be referred to a standard metal, in this case perhaps solid fine gold. Hardness measurements on fine gold made under a series of different loads could then be compared with measurements on samples of gold deposits made with the corresponding loads. These samples, then, can be said to be so many times harder than the standard metal. In this way, differences in instrumentation and technique could be eliminated and results by different observers could be on a more comparable base.

In conclusion, it should be stated that thickness as well as hardness measurements on electrodeposits of precious metals should be made and interpreted with the greatest care and discretion. If this is not done, errors and misconceptions are apt to find their way into reports which, then, often become records or specifications.

For all hardness measurements it is important that all the factors of the test such as load, time of descent, time of application of the load, etc., should be stated clearly, in order to permit comparable and reproducible results.

Acknowledgement

This work was done in the laboratories of Sel-Rex Corp. and is published with permission of the management. The guidance and advice of *Dr. Karl Schumpelt* is gratefully acknowledged.

Surface Preparation of Metals

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CLEANING operations frequently have been regarded as of minor importance and, as a result, this phase within an operational sequence has received scant attention. However, the ever-increasing severity of cleaning specifications, the necessity of programming more closely-scheduled cleaning sequences, high labor costs, and the tendency toward design of more complicated sections, have rapidly advanced metal cleaning from a guesswork procedure to that of a science.

The many methods employed for the protection of a metallic surface and/or enhancing the value of the article for consumer "eye appeal" have their success directly influenced by the kind of preparation the surface receives prior to the application of either a surface coating or treatment. Thus, as exemplified by an electroplated, galvanized, tinned, painted, or chemical conversion coating, the adhesion, continuity, and general durability of the coating will be affected by the presence of surface contaminants. In addition, cleanliness of surface is also required where it will be protected by a preservative.

Methods of Cleaning

The two major classifications within this category would be (a) mechanical cleaning methods which include sand blasting, tumbling, shot blasting, and scratch brushing, and (b) chemical cleaning methods which remove surface contaminants by the use of alkalies, solvents, emulsions, acids, etc. Of immediate interest is the latter method of cleaning in which the dirt is removed by solution, saponification, emulsification, or a combination of these actions.

A considerable portion of metal cleaning procedures involve the use of one or more chemical methods; the choice of procedure being dependent upon a number of factors which would include the following:

(a) the contaminant to be removed which may include all oil or grease, metal chips and abrasive particles, rust, drawing and buffing compounds, charred lubricants or quenching oils, shop dirt, flux, hardening salt and, in the event a preservative will be used, water may be objectionable;

(b) the physical aspects of a contaminant, whether it exists as a thin film or as a thick layer. A loose soil may require a light duty cleaner, whereas, an adherent soil may call for a heavy duty penetrating and suspending agent;

(c) the degree of cleanliness required; i.e., a somewhat higher order of cleanliness is required for surfaces that are to be electroplated than those that are to be painted;

(d) the material. Steel parts are not attacked by strongly alkaline solutions, whereas, aluminum, brass, and die-cast parts will require buffered or inhibited chemicals which will act on the soil without attacking the basis metal. On complete assemblies, the active metal will govern the choice of cleaner;

(e) the availability of cleaning materials and equipment; and,

(f) the hazards that may be involved such as fire, toxicity, etc.

Surface contaminants that are organic in nature will include slushing oils employed for temporary protection during storage, lubricants that facilitate prior forming operations, as in stamping, deep drawing and machining, and various polishing and buffing compounds. Those contaminants that are basically an animal or vegetable fat may be removed by a relatively strong alkali solution. On the other hand, mineral oils may be removed[1] by emulsification with soaps, soap substitutes, such as the alkali salts of sulfonated naphthalene or higher alcohols, and other substances that are capable of reducing the surface tension of water. There are also organic solvents available that have the ability to remove both animal and vegetable oils as well as the mineral oils.

Solvents

Of increasing importance is the use of organic solvents for the removal of soil; this family frequently being classified as either petroleum, chlorinated, or specialized solvents. The petroleum solvents, which are petroleum distillates or "cuts" of sufficiently high flash point, are normally used at room temperature. Excellent solvent cleaning of mineral or vegetable oil contaminants are obtained; however, they do not remove inorganic residues or perspiration. The chlorinated solvents, which are used mainly in vapor degreasing techniques, are also limited in the removal of oil, grease, and waxes. Specialized solvents are generally used in connection with either petroleum or chlorinated solvent cleaning procedures and are designed to remove some of the inorganic residues which the ordinary solvent types do not touch.

The desired properties of solvent cleaners would include[2] high solvent power, low specific and latent heat, nonflammability, nontoxicity, stability and an inertness toward metals, a boiling point below 212°F., heavier than air in the vapor state and of high specific gravity and low surface tension in the liquid state. Unfortunately, there is no commercial solvent that fully meets all of these requirements.

The hydrocarbons are considered to have excellent solvent powers; however, they are highly flammable. The chlorinated hydrocarbons are also considered good solvents but are relatively toxic; however, this class of material has so many other advantages that it is universally accepted as a solvent. Examples of the better known chlorinated hydrocarbons would include carbon tetrachloride, trichlorethylene, and perchlorethylene.

Carbon tetrachloride was one of the first chlorinated hydrocarbon solvents adapted to metal degreasing operation in liquid baths. From long observation and toxicological studies, this solvent type has been classed as highly toxic and harmful in industrial degreasing when used as a liquid cleaner in open containers. It does not lend itself to vapor type degreasing due to its low boiling point and light, easily diffused vapors. Trichlorethylene, which contains a stabilizer, is frequently selected as a degreasing solvent. It is classed as nonflammable at ordinary temperatures and moderately flammable at higher temperatures with a fire hazard rating of three. Tetrachlorethylene (perchlorethylene) is listed by the Underwriters' Laboratories, Inc., as non-flammable with a fire hazard rating of zero.

Although swabbing large structures as well as immersion in hot, liquid solvent is frequently used in the removal of heavy accumulations of grease and oil, the more effective method is that of vapor condensation which frequently may be automatic in operation. Combination cycles are also available, depending upon both the type and amount of contaminant. These cycles may be briefly given[6] as:

(a) Vapor only:—Straight vapor degreasing is highly efficient when the soil to be removed is small in relation to the metallic mass of the parts to be degreased;

(b) Vapor and Final Flushing:—Where the soil retains chips, machinings, filings, etc., the parts are immersed in the vapors which removes the solubles. The remaining insolubles are then driven from the part by flushing with clean solvent;

(c) Cold Pre-dip and Vapor:—This cycle is often recommended for cleaning highly polished light-gauge metals that appear clean after a polishing operation but require a complete destruction of surface tension. This cycle may also be used to remove low-flash-point solvents before subjecting the parts to hot vapors;

(d) Cold Pre-dip, Vapor, and Final Flush:—This cycle offers the same advantages as cycle (c) except that the final flush will remove stubborn accumulations of compounds, residual films, chips and other insolubles.

(e) Boiling Dip, Cool Rinse, and Vapor:—The complexity of modern processing oils, waxes, and greases often requires the agitated emulsifying action of a boiling solvent before thorough removal of soil takes place. The parts travel from boiling dip to rinse in which the temperature of the parts is lowered sufficiently to insure final cleaning in pure solvent vapors;

(f) Boiling Dip, Cool Rinse, Vapor, and Final Flush:—This cycle is similar to cycle (e) with the exception that pressure flushing is added to reach blind holes, flanges, recesses and other areas prone to retain partially contaminated solvent or otherwise undesirable accumulations; and,

(g) Vapor, Cool Rinse, and Vapor:—At times the insolubles in processing compounds tend to "bake on" when the part is submerged in boiling solvent. Adequate cleaning may be obtained by exposing the part to the vapors, followed by a "slushing" action of the cool rinse solvent and finally, a vapor exposure to complete the cleaning cycle.

In a cleaning operation the oils, greases, waxes, and tallows, which are entirely miscible with both trichlorethylene and perchlorethylene, are flushed into the main boiling sump of the degreaser where these oils and greases go into absolute solution with the solvent. Most of these contaminants have boiling or vaporizing points well above the maximum temperature of the solvent and, ordinarily, will not vaporize over with the vapor itself to re-deposit oily fluid on the work during condensation.

A hydrometer is normally used to check the degree of solvent contamination (Table 1), although a thermometer may also be used for this purpose. Solvent recovery of contaminated solution may be realized by a simple distillation process. There are trichlorethylene solvents in which the inhibitor will come over with the vapors and are thus included in the recovered solvent. Other inhibitors are lost during distillation and, therefore, must be added to recovered solvents to neutralize acid formations. The perchlorethylene solvent types are likewise formulated with both carry-over and non-carry-over inhibitors, if necessary, although the tendency of these solvents to decompose during distillation is not as great as that of trichlorethylene. Incineration of the residue after a distillation process is recommended since it is toxic, subject to spontaneous combustion, or has other objectionable properties that makes it a hazard on either a public or a private dump.

Vapor degreasing will not remove soap or water-soluble salts and acid, which may make it necessary to follow the degreasing operation with a water spray rinse. In addition, this method does not produce the high degree of surface cleanliness required for electroplating.[2]

Solvent Emulsions

Emulsion and di-phase cleaners are employed to an ever increasing extent since they serve as an effective agent in the removal of both solid and organic contaminants; exhibit a relative inactivity with the light metals such as the aluminum and zinc base alloys, and have characteristic low toxicity when compared to the chlorinated hydrocarbons.

TABLE 1

Indicated Oil Content by Volume	Specific Gravity Perchlorethylene	Specific Gravity Trichlorethylene	Boiling Point Perchlorethylene	Boiling Point Trichlorethylene
None	1.61	1.46	250.2°F.	188.8°F.
10%	1.55	1.41	252	190
20%	1.48	1.35	255	192
30%	1.41	1.29	260	195
40%	1.34	1.23	264	198
50%	1.27	1.17	270	203
60%	1.20	1.12	280	211
*Maximum Allowable Temperature			295	235

Stable emulsion cleaners, which consist essentially of a hydrocarbon emulsified with a small amount of water by means of pine oil, potassium oleate or some other emulsifier soluble in a hydrocarbon,[4] are used to their full advantage in both pressure spray and agitated solutions. Concentrations employed will vary from 1.0 to 10.0 per cent water solutions operated within the temperature range of 130 to 160°F. A slight oil film is left on the metal which serves to prevent rusting but which must be removed where a chemically clean surface is required, as exemplified in either a plating or enameling procedure. The degree of cleanliness obtained frequently is satisfactory for organic finishing, particularly if the finishing operation is preceded by a conversion coating treatment such as phosphating.

If the soil to be removed is relatively difficult, a small amount of alkali, about ½ oz./gal., may be added. Where a chemically clean surface is desired, an alkali cleaning cycle must follow emulsion cleaning. This combination will permit a decrease in the immersion time required for alkali cleaning and, thus, assure the removal of both solid dirt and interfering oily films.

Emulsified solvent cleaners may also be used without dilution with water; this type being preferred for the removal of heavy soil, such as pigmented drawing compounds, greases, rust preventives, and buffing compounds. Since they are used in the undiluted form, their subsequent higher cost limits their use in the removal of the abovementioned heavy coils. Frequently, a typical cycle would consist of hand scrubbing, soaking, and then rinsing either in an agitated tank or with a hose. These solvent cleaners are frequently considered to be in direct competition with the chlorinated solvents previously discussed; the factors to consider in the selection of the solvent cleaners being emulsifiability and flash point.

Di-phase cleaners, as the name implies, consist of a solvent phase that floats as a separate layer on the top of a water solution; neither phase being completely or permanently emulsified in the other. As in emulsions, these cleaners are considered to be more effective when used in spray equipment and agitated solutions as compared to soak tank cleaning. In addition, since an oily film remains on the surface of the part after di-phase cleaning, the degree of cleanliness obtained will be satisfactory for surfaces to be painted, the use of a subsequent alkali cleaning operation being recommended whenever a chemically clean surface is required. Di-phase cleaners are also considered superior to stable emulsions in deflocculating and suspending solid contaminants.[1]

Alkalies

Alkalies and alkline-base cleaners are undoubtedly the oldest and most prevalent method in the removal of surface soil. As a result, a wide variety of proprietary formulations are available, including light duty cleaners, which are relatively free of caustic alkali, for use on corrodible or tarnishable metals; medium duty cleaners of buffered alkalinity for general service; and, the heavy duty, high alkaline cleaners. Due to their large scale manufacture, an attractive feature is their relatively low cost.

An efficient alkaline cleaner would have the following stated properties[5] which are listed in their order of importance, thus: (a) dissolving power and high alkalinity; (b) dispersing power for solids; (c) emulsifying power for liquids; (d) rinsability; (e) low surface tension and wetting ability; (f) stability; (g) good conductivity in the event of use in electrolyte operations; (h) effectiveness at low concentrations for reasons of economy; and, (i) freedom from toxicity.

To approach the above-stated desired properties and to provide an inherent ability to remove a variety of both solid and liquid contaminants, an alkaline cleaning compound will contain a number of constituents. As an example, it has been stated[1] that proprietary compounds for cleaning steel may contain 30 to 55 per cent sodium orthophosphate, 10 to 50 per cent caustic soda, 10 to 60 per cent soda ash, and 2 to 10 per cent of a wetting agent which may be a soap, a synthetic detergent, or a surface-active material such as the sodium salts of sulfonated alcohols. They may also contain alkali silicates from 30 to as high as 85 per cent. Proprietary compounds for the more active metals, such as the aluminum alloys, are more mildly alkaline and would contain soda ash, orthophosphate and metasilicate (Table 2).

Although sodium hydroxide maintains high alkalinity upon the introduction of acid soils, it is not considered as effective a cleaner as the alkali silicates. Caustic soda is known to be a poor wetting agent and difficult to rinse, whereas, the alkali silicates display good wetting, emulsifying, and rinsing properties. Liddiard[9] indicated that the effectiveness of the alkali silicates is dependent upon the ratio of SiO_2 to Na_2O within the compound. Thus, the orthosilicate, in which this ratio is 1:2, has the best detergency effect and is

an effective addition in both electrolytic and soak cleaners. The metasilicate, in which the ratio is 1:1, is used in general purpose cleaners and, particularly, in cleaners for aluminum where the silicate film inhibits excessive alkali attack.[10] The variable composition waterglass compounds, in which the ratio of SiO_2 to Na_2O is at 3.3 to 1 and 2.0 to 1.0, are colloidal and thus advantageous in deflocculation but are not recommended for electrolytic cleaners owing to their electrophoretic behavior.[1]

Both the silicates and the phosphates serve as buffers, thus assuring a more uniform cleaning action. The silicates show a buffering action between a pH of 9 to about 11.5, whereas, the phosphates, particularly orthophosphate, have a buffering action that is between a pH of 8 to 11. In localities where hard water is encountered, both the pyrophosphates[7] and sodium hexametaphosphate[8] are cleaner additions due to their water softening ability.

An increased surface activity of modern cleaners is obtained by the use of soaps and synthetic detergents; the latter group of compounds being known as "syndets" which embraces a variety of sulfonated aliphatic and aromatic hydrocarbons. Faster cleaning action is obtained by decreasing the surface tension of the cleaning solution and by a break-down of interfacial tension, making it possible to get dirt away from the metal and into the solution. An exception would be the cleaners used for washing machines where the normal detergent addition will cause excessive foaming. In this case, a synthetic detergent is not usually required since the mechanical action of cleaning will assure forceful scouring. Another exception would be in electrolytic cleaning, since it has been found that detergents are frequently prone toward decomposition.

Modern day alkaline cleaners are composites in which silicates, phosphates, borates, and carbonates, along with detergents, soaps, and wetting agents, have replaced the hot caustic baths. These new cleaners work by solution, chemical reaction, and emulsification in which heat-treating salts, acid deposits and other inorganic dirt, as well as oil and grease films are readily and economically removed. Equipment is less costly and more easily installed than that required for solvent cleaning.

Electrolytic Cleaning

Alkaline cleaners may also be used electrolytically whereby an increased rate of reaction is obtained by the liberation of either hydrogen or oxygen gas bubbles at the surface of the work being cleaned. These bubbles exert a mechanical scrubbing action which loosens adherent dirt. Cathodic cleaning, which is frequently termed "direct cleaning," has an advantage in that there is twice the amount of gassing at the cathode as compared to the amount at the anode. A disadvantage is that any metal which may be in solution in the bath is deposited on the surface of the work. Where there may be a danger of hydrogen embrittlement, anodic rather than cathodic cleaning is the preferred method. Anodic, or reverse cleaning, has the advantage in that current flows from the work and thus there is no danger of a plating action. However, there is a possibility of etching the work if it is allowed to remain in the bath for prolonged periods.

Some installations have means such as a double-throw switch to change from cathodic to anodic, especially for non-ferrous metals, to deplate smut that may have been deposited during cathodic action. In this combination the major portion of the cleaning cycle is done with the work as the cathode. Standard practice employs direct current, 3 to 9 volts, with a current density of 25 to 100 amp./ft.^{2} depending on the type of cleaner, nature of the work, and the soil to be removed. Cleaner concentrations of 3 to 10 oz./gal. are generally used with the baths operating at temperatures from 160°F. to boiling.

Ultrasonic Cleaning

Ultrasonic cleaning is a fairly recent innovation; an increase in the rate of soil removal being realized. A transducer placed near the surface of the work to be cleaned during immersion in a cleaning solution, converts electrical vibrational energy into mechanical vibrational energy. The energy level is sufficiently high to physically rupture the fluid, which is stated to create a mechanical scrubbing action along the surface of the work and, thus, increase the rate of reaction in removal of soil.

Typical installations[14] include the removal of lap-

TABLE 2

Relative Alkalinity and pH of One Per Cent Solutions of Alkaline Compounds[1]

Sodium Compound	*Chemical Formula*	*Total Na_2O %*	*Active Na_2O %*	*pH*	*Equivalent Cleaner**
Hydroxide (Caustic soda)	$NaOH$	77.5	75.5	13.4	1.0
Sesquisilicate	$Na_6Si_2O_7 \cdot 11H_2O$	24.7	23.8	12.7	3.2
Metasilicate	$Na_2SiO_3 \cdot 5H_2O$	29.2	28.0	12.5	2.7
Orthophosphate	$Na_3PO_4 \cdot 12H_2O$	18.0	10.0	12.0	7.6
Silicate (Waterglass)	$Na_2O \cdot 1.6SiO_2$	19.7	18.7	12.0	4.0
Carbonate (Soda ash)	Na_2CO_3	58.0	29.0	11.4	2.6
Silicate (Waterglass)	$Na_2O \cdot 2SiO_2$	34.0	31.9	11.3	2.4
Silicate (Waterglass)	$Na_2O \cdot 3.2SiO_2$	23.8	21.3	10.2	3.5
Pyrophosphate	$Na_4P_2O_7$	23.3	8.1	10.1	9.3
Tetraborate	$Na_2B_4O_7 \cdot 10H_2O$	16.3	8.4	9.2	9.4

*The values in this column are the number of grams of alkaline compound required to give the same amount of active Na_2O as one gram of sodium hydroxide.

ping compound, chips, and cutting oil from honed ball bearing races, utilizing a mineral seal oil bath as the solvent; the cleaning of automobile steering assemblies in ultrasonically activated trichlorethylene; and the cleaning of watch movements in a number of ultrasonic baths including a light petroleum distillate followed by organic solvent rinse. To efficiently use ultrasonic techniques, the two prime points to observe include (a) the development of sufficient mechanical energy in relation to the surface area so that all surfaces can be reached — this being a question of sufficient capacity of equipment, and, (b) that ultrasonic cleaning can only be realized within these areas where the cleaning liquid can penetrate.

Methods

Metal cleaning is usually accomplished by six general methods of handling the work in relation to the cleaning medium, namely: (a) still tank, (b) electrolytic tank, (c) power washer, (d) steam gun, (e) solvent vapor degreaser and (f) abrasion with grit, shot blast or tumbling. The last-mentioned method may be eliminated in this discussion since mechanical methods are not considered. Methods (b) and (e) have been discussed to some extent. The other three will be considered briefly.

The simplest method, in which the solution is kept at a rolling boil to supply agitation, is that of soak tank cleaning. Further agitation is obtained by artificial means which would include shields, steam jets, circulatory heaters, propellers, pumps, and work movement — either manually or mechanically. Air as a means of agitation is not recommended. In alkali cleaning, air will lower the temperature of a hot solution and introduce a CO_2 component which may increase the carbonate content and thus reduce the efficiency of the cleaner. When non-ferrous metals are thus cleaned, the added oxygen will cause such metals to tarnish.

Power washers, either the conveyorized washing machine or the rotary drum type, will speed up production and provide efficient cleaning on work-pieces where all surfaces of the design are accessible to the cleaning solution. Cleaning is accomplished by passing parts through numerous high pressure sprays of low dilution alkaline cleaning solutions. The increased mechanical action permits the use of low concentrations, on the order of ½ to 1 oz./gal. Cleaners containing synthetic detergents cannot be used in washing machines because of excessive foaming.

The steam gun is a convenient tool for cleaning large structures that cannot be conveniently immersed in a conventional cleaning tank. These units are normally quite compact, portable, precisely controlled, and safe. The solution used may be fortified with either an alkaline or emulsion type cleaner, which aids in the removal of grease, dirt, or similar surface contaminants. The efficiency of the operation is dependent upon both the power and penetration of the steam jet as well as the type of cleaner employed.

Descaling

Surface oxides may be removed from metals either by a chemical pickling procedure or by a mechanical abrasion of the surface. Chemical pickling, which is of immediate interest, would include immersion in acid solutions as well as molten salt immersion. A third category, termed the acid cleaners, may be considered as a special purpose material which may clean and pickle the metal in the same operation.

Acid Cleaning:

Phosphate type cleaners are undoubtedly the most widely used materials within this category, they being particularly effective in the removal of light soil and very light rust. The acid phosphate cleaners also will provide a uniformily thin inert film of insoluble metallic phosphate on the surfaces of ferrous metals which provide (a) a better bond for subsequent paint coatings, (b) an excellent base for adhesion of a drawing lubricant; and, (c) temporary protection against rusting. The detergent type of iron phosphate system is frequently very effective in the removal of mineral and rust preventive oils, especially in spray equipment.[13]

Acid Pickling:

Wide variations are possible in the strength, temperature and types of acid solutions used; the procedure employed depending upon such factors as the material to be pickled, the character of the scale involved, and the surface desired after the pickling operation. Although pickling appears to be a simple process, numerous refinements and modifications of recommended solution types and procedures are necessary. Thus, due to the broad influence of the variables of scale formation, along with the differences in processing practices and equipment, even in two plants making the same product, it is not practical to reduce this problem to a standard or set procedure. The value of those procedures found in the literature, which have been used successfully under a specific set of conditions, is that they may serve as a guide and, when necessary, may be modified to meet a particular set of conditions.

Acids generally used are sulfuric, muriatic, nitric, and hydrofluoric, or mixtures of these acids. Sulfuric acid is the most commonly used pickling agent by reason of its economy. Muriatic acid may be used for special purposes as exemplified by its action in scale removal and surface etching prior to galvanizing and tinning. Nitric acid is used in pickling the stainless steels and is occasionally employed to oxidize scaled surfaces. Hydrofluoric acid frequently is added to a bath to accelerate the pickling action, and is used occasionally in pickling castings to remove sand.

The action of a pickling solution is approximately in direct proportion to the acid concentration up to a limiting value, usually given as 25% acid by weight. Since speed of reaction is also dependent upon both the immersion time and bath temperature, acid concentration may vary with these two factors. Thus, a concentration of about 5% acid at a temperature of 190°F. may very likely be raised to about 10% acid to compensate for decreased activity at a lower temperature. Judicious choice of these factors of acid concentration, pickling time, and temperature are required since any one factor may cause over-pickling to occur.

Agitation saves time, metal, and acid. Air, steam,

or mechanical movement may be used, this solution movement permitting the dislodgement of loose scale and the maintenance of desired solution strength at the metal-liquid interface. Pickling baths that are allowed to remain stagnant tend to form gas pockets which very likely will result in a non-uniformity of the pickling action.

Pickling inhibitors, by definition, may be classified as agents which diminish the attack of the acid on a metal surface without appreciably retarding the rate of scale removal. The use of an inhibitor frequently establishes the limiting temperature of a bath since some inhibitors fail rapidly at high pickling temperatures. In addition, they are frequently quite effective in extremely small concentrations. Many of these inhibitors are extremely complex in structure and high in molecular weight. Aldehydes, thioaldehydes, mercaptans, and other sulfur-containing organic compounds, organic nitrogen bases and their derivatives, particularly those in which the nitrogen is linked within a heterocyclic ring such as pyridine and quinidine, seem to be favorites.

ELECTROLYTIC PICKLING:

Electrolytic pickling processes are far more rapid than still pickling, requiring in most cases from 1 to 3 minutes for completion as compared to a 10 to 15 minute cycle for batch pickling. Other advantages include a reduction in acid consumption, decreased solution of basis metal, and minimization of hydrogen embrittlement. Anodic pickling, which frequently is carried out in a 30% sulfuric acid solution at a current density of 10 to 75 amp./ft.^{2}, may be used for the surface preparation of metals to obtain a mild etch, suitable for the application of heavy electrodeposits or hot dipped coatings. Cathodic pickling, in which a current density of 100 to 300 amp./ft.^{2} is used, has the advantage that little or no metal will be removed from the surface. In some cases, a combination of anodic and cathodic pickling is used for high speed, continuous operation.

Some disadvantages of electropickling include the equipment costs necessary for the generation of electric current, the necessity of maintaining good electrical contacts and the need to control both bath temperature and acid concentration to a greater degree than that required for still pickling. Acid drag-out losses may be much higher for electropickling since a higher acid concentration is frequently employed. A distinct disadvantage of cathodic pickling is that hydrogen embrittlement may be equal to or greater than that realized in still pickling; however, anodic pickling will result in little embrittlement.

SALT BATH DESCALING:

In comparison to acid pickling processes, salt bath descaling procedures have limited use. However, when applicable, this process will minimize the requirements for proceeding time, labor, and metal loss. An outstanding characteristic of these baths is their versatility in materials that may be processed.

The sodium hydride process[3] which may be used in descaling every metal and alloy with the exception of the aluminum, magnesium, and low melting point nonferrous alloys, consists of a caustic soda bath containing about 1.5 to 2.0% sodium hydride; the bath operating at a temperature of about 700°F. The active descaling agent is sodium hydride which is maintained in the bath at the recommended concentration by reacting metallic sodium and hydrogen. The process is essentially "reducing" and there is no danger of overtreatment since the reaction stops when reduction is completed. A portion of the reacted surface scale is removed in the bath to form a sludge, while the remainder is removed by a subsequent water quenching operation. An acid brightening dip and water rinsing follow. Advantages include economical operation on even the most adherent scale formation; rapid removal of scale; the absence of any undesirable reaction with the basis metal; and, the use of low cost, compact equipment which may be adapted to manual, conveyorized, or continuous operation.

Another fused salt process,[11] consisting of caustic soda, sodium nitrate and other chemicals, operating within the range of 800 to 930°F., has been widely used in descaling stainless steels, the nickel base alloys such as Monel and Inconel, standard alloy steels, and the titanium base alloys. The bath is oxidizing, chemically converting the scale to a higher order oxide during the immersion period in the fused salt. Unequal expansion rates of the steel and the surface oxide, as well as the softening action realized during the conversion period within the fused salt, will cause slight cracks and separation in the scale. Further degeneration of the scale occurs in the subsequent water quench, which permits its complete removal in a 1 to 5 minute dip in dilute muriatic or sulfuric acid. The advantages of this process are similar to that stated for the sodium hydride procedure.

Another source[12] offers two types of oxidizing salt descaling baths and an alkaline electrolytic bath. The oxidizing baths operate very similarly to the type previously discussed; differing in the degree of oxidation that occurs. The electrolytic bath is a combination oxidizing and reducing salt bath to produce a metallurgical clean surface. The oxidizing cycle, with the work anodic, removes oils, greases, organic materials, graphite and carbon, whereas, the reducing cycle, with the work cathodic, removes sand and rust. Combination oxidation and reduction cycles can be employed after which the work may be submitted to a bright acid dip and water rinses.

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Ultrasonics In Zinc Electroplating

Effect on Elastic Properties of Steel

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HYDROGEN embrittlement of high strength steels as a result of cadmium or zinc electroplating used for the purpose of corrosion protection presents an increasingly serious problem as the strength of steels increases. The loss of elastic properties of steel as a result of electroplating is attributed to the diffusion of hydrogen into the metal in the process of electrodeposition or cleaning operations.

Recently two Russian researchers, A. M. Ginberg and A. P. Goring, conducted a series of experiments in which they tried to solve the problem of hydrogen embrittlement by application of ultrasonics. They described their experiments and results in an article published in the August 1959 issue of "Metal Science and Heat Treatment" (U.S.S.R.). The editor of the magazine, however, believes that the results of these experiments are relative and true only for the experimental conditions described. According to him, the method of introduction of elastic vibrations used by the authors is inefficient because of loss of part of the energy in the transition from the magnetostrictive transducer into the solution and from the solution to the bottom of the vessel containing the solution. The conditions for the transition of vibration at a frequency of 16 kc through the bottom of the vessel are not favorable and depend on the material, the thickness, and the diameter of the bottom of the vessel.

The results of the experiments, however, do present a certain interest, and the purpose of this article is to acquaint American readers with the attempts of the Russian researchers in this direction.

A decrease in mechanical properties and embrittlement of steel have been observed as a result of chemical or electrochemical treatment of steel in alkaline and acid solutions.[1] It also has been established that the elastic properties of steel decrease as a result of hydrogen diffusion in acid zinc electrolytes less than in cyanide solutions.[2,3] Now, however, in zinc plating from acid baths the surface of parts such as coiled springs fails to receive full coverage because of low throwing power of these electrolytes. The Russian researchers decided to explore the possibility of application of ultrasonics with cyanide solutions which possess a superior throwing power.

It is a well known fact[4,5] that ultrasonics sharply accelerates the rate of many chemical processes, among them cleaning and pickling. It is also known that ultrasonics affects the potential of hydrogen evolution and the removal of hydrogen from the surface of the object. Ultrasonic waves of low intensity can produce weak polarizing action and those of high intensity can produce strong depolarizing action which, in some instances, is so significant that the hydrogen evolves at a potential below the reversible equilibrium potential.

These phenomena can be explained by the fact that, as a result of cavitation at a certain intensity of the ultrasonic field, some hydrogen is liberated from the cathode at the electrode-liquid interface.[4,5] The

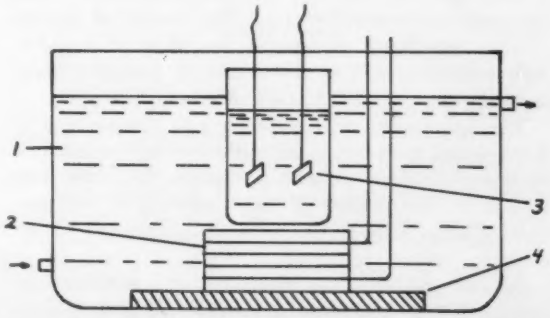

Fig. 1. Diagram of an apparatus for cleaning, pickling, and electroplating with the use of ultrasonics: 1—thermostat; 2—ultrasonic generator; 3—electrolytic cell; 4—layer of lightweight rubber.

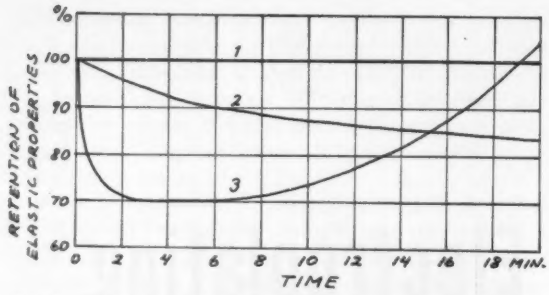

Fig. 2. Effect of cleaning time on the change in elastic properties of spring steel: 1—material in the initial state; 2—alkaline cleaning without the use of ultrasonics; 3—alkaline cleaning with the use of ultrasonics.

cavitational bubbles adhering to the surface of the electrode form a vacuum which sucks in the hydrogen from the metal surface.

The hydrogen bubbles liberated on the cathode receive an accelerated impulse in the ultrasonic field as a result of a sound wave reflected from the liquid-gas interface.[6] The action of ultrasonic vibrations is similar to intensive mechanical agitation of the electrolyte, ultrasonics, however, being more effective. A certain intensity of ultrasonic vibrations, however, gives no rise to the gas bubbles on the cathode.

The Russian researchers studied the effect of ultrasonics on hydrogen absorption and the change in mechanical properties of steel springs. They used a strip of steel heat treated to a hardness of Rockwell C50 and containing 0.75-0.85%C, 0.25-0.35%Mn, 0.3%Si. Samples made from this steel in the form of flat springs 150 x 10 x 0.3 mm in size were subjected to annealing at 270-280°C. for 2 hours with subsequent air-cooling. The samples were alkaline cleaned, acid pickled, and zinc plated with and without the use of ultrasonics, and subsequently physically tested with a special apparatus.

The ultrasonic field was formed by the use of a magnetostrictive transducer and an ultrasonic generator of the type "Gzuk-2." The frequency of the imposed ultrasonic field was 16 kc, and the specific power was 25 watt/cm.^{2} A diagram of the apparatus for cleaning and electroplating processes with the use of ultrasonics is shown in Fig. 1.

The elastic properties of steel samples were studied with an apparatus equipped with a special mechanism for secure clamping of specimens, with an angle gauge and a device for measuring the number of bends.

A sample was bent 180° on sponges 3mm in radius at a constant controlled rate. The design of the apparatus completely eliminated the effect of any subjective factors such as differences in pressure, bending rate, etc., on the accuracy of readings.

The test results were expressed in the number of bends a test specimen could withstand before fracture. In order to obtain relative values the test data were related to the number of bends leading to the fracture of an untreated specimen and converted to per cents.

Alkaline cleaning was conducted in a solution containing 100 g./l. sodium hydroxide, 50 g./l. sodium carbonate, and 20 g./l. petrov agent. The solution temperature was 90°C., the cleaning time was 5, 10, 15, and 20 minutes. Cleaning with ultrasonics was conducted in a similar solution at 60°C.; the cleaning time in this case was 0.5, 1, 2, 5, 10, 15, and 20 minutes.

With the use of ultrasonics the rate of cleaning increased 3-4 times. The effect of the cleaning time on elastic properties of steel is shown in Fig. 2. The diagram indicates that alkaline cleaning produces deterioration of mechanical properties of steel springs. The greatest change in mechanical properties normally takes place during the first 6-8 minutes and then becomes negligible.

The decrease in elastic properties of steel in alkaline cleaning evidently is related to the hydrogen evolution as a result of the interaction of steel with alkali. An increase in temperature of the solution considerably increases the loss of mechanical properties.

With the use of ultrasonics a sharp decrease in mechanical properties of springs (up to 25-30%) takes place during the first few minutes of cleaning. Subsequently, the elastic properties begin to recover and, after 19-20 minutes, reach the original state.

It can be assumed that the sharp decrease in elastic properties in the beginning of treatment takes place as a result of activation of the steel surface by ultrasonics, which increases interaction of metal with alkali and also hydrogen adsorption by the surface. During the first 7-8 minutes the saturation of steel with hydrogen takes place, whereupon, the hydrogen diffusion practically ceases. Under the action of ultrasonics the phenomenon of cavitation creates a vacuum at the metal-electrolyte interface (when the cavitational bubbles close up) and the hydrogen is sucked out of steel.

Pickling of steel springs was conducted in a 2N solution of inhibited and uninhibited hydrochloric acid. The inhibitor used was in a concentration of 8-10 g./l. It was established that the use of ultrasonics increased the rate of pickling 3-5 times in the inhibited acid solution.

The effect of pickling time on the change in elastic properties of steel is shown in Fig. 3. Pickling steel for 5 minutes in the solution containing inhibitor results in a 2% decrease in elastic properties. Pickling for 20 minutes in the presence of the inhibitor produces an 11% decrease and, without the inhibitor, a 52% decrease in elastic properties.

During the first 2 minutes of pickling with the use of ultrasonics no decrease in elastic properties was observed; however, as the pickling time increased, a sharp decrease in elastic properties took place. This

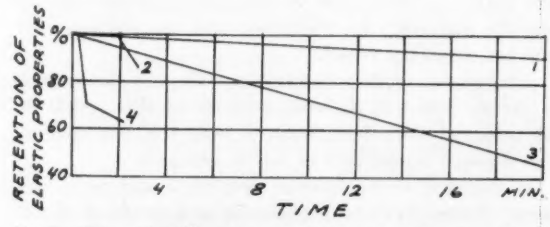

Fig. 3. Effect of pickling time on the loss of elastic properties of steel: 1—with the use of inhibitor but without the use of ultrasonics; 2—with the use of both inhibitor and ultrasonics; 3—without the use of either inhibitor or ultrasonics; 4—without the use of the inhibitor but with the use of ultrasonics.

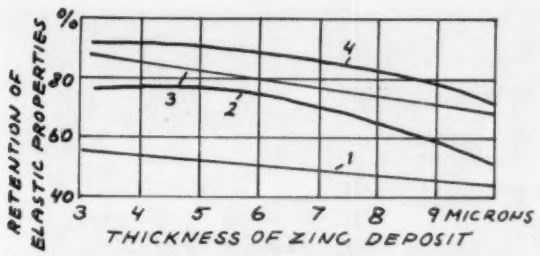

Fig. 4. Effect of thickness of zinc deposits from acid and cyanide electrolytes on the loss of elastic properties of steel springs: 1—cyanide electrolyte; 2—same with the use of ultrasonics; 3—sulfate electrolyte; 4—same with the use of ultrasonics.

phenomenon can be explained by the desorption of the inhibitor from the metal surface as a result of cavitation arising in the pickling solution with the use of ultrasonics.

Pickling in the same solution of hydrochloric acid but without the inhibitor and with the use of ultrasonics produced a negligible change in elastic properties during the first 20 seconds, which coincided with the results obtained in picking of steel in the hydrochloric acid solution containing the inhibitor.

An increase in pickling time up to 1 minute greatly decreased the elastic properties of steel. This can be explained by the increased rate of dissolution and adsorption of hydrogen atoms by the surface of the steel springs as a result of its considerable activation by ultrasonics.

Zinc plating of springs was conducted at 20°C. in sulfate and cyanide electrolytes whose composition is given below.

1. *Sulfate Electrolyte*:

Zinc sulfate	250 g./l.
Aluminum sulfate	40 "
Sodium sulfate	80 "
Dextrin	10 "
pH	4.1 "

2. *Cyanide Electrolyte*:

Zinc oxide	40 g./l.
Sodium cyanide	90 "
Sodium hydroxide	70 "
Sodium sulfide	5 "

Current density in zinc plating from sulfate and cyanide solutions was 1 and 5 amp/dm^2 respectively.

Prior to zinc plating, all samples were anodically cleaned for 5 minutes at a current density of 6 amp/dm^2. then rinsed and pickled for 5 minutes in a 2N solution of hydrochloric acid containing 8 g./l. inhibitor. The thickness of zinc deposits on the springs ranged from 3 to 10 microns (1 micron = 0.00004").

The change in mechanical properties of springs with increased thickness of zinc deposits from sulfate and cyanide electrolytes is shown in Fig. 4.

The use of ultrasonics in zinc plating from cyanide and acid electrolytes results in improved elastic properties of springs. However, ultrasonics produce this effect only in the beginning of electrolysis (during the formation of zinc deposits up to 5-6 microns in the cyanide electrolyte and up to 6-7 microns in the sulfate electrolyte); subsequently, the mechanical properties of the springs decrease and, with a deposit of 10 microns, approach the properties of springs zinc plated in electrolytes without the use of ultrasonics.

The improvement in elastic properties of springs with the deposits of 6 microns obtained from the acid and cyanide solutions with the use of ultrasonics constituted 12 and 20% respectively.

It can be assumed that the use of ultrasonics accelerates the zinc deposition on steel, and that the deposit forms a barrier to the penetration of hydrogen into the metal (as a result of the use of higher current densities). An increase in elastic properties takes place during the first few minutes of electrolysis.[7] Longer electroplating time results in increased hydrogen adsorption by the metal due to the fact that the rate of hydrogen adsorption (physical adsorption) increases on the zinc surface activated by ultrasonics. In individual cases, zinc deposits over 10 microns resulted in partial recovery of elastic properties of the steel, this phenomenon being related to the effect similar to the one produced by ultrasonics in cleaning.

It must be noted that the mechanics of the effect of ultrasonics on hydrogen adsorption is not yet established definitely, and the researchers' assumptions require additional experimental verification.

Conclusions

1. Alkaline cleaning in hot solutions containing 100 g./l. NaOH results in some loss of elastic properties of steel with a hardness of Rockwell C50. The use of ultrasonics in cleaning at first results in a sharp loss of elastic properties, then the elastic properties of steel return to their original values.

2. Ultrasonics increases the rate of pickling 3-5 times in a hydrochloric acid solution containing inhibitor. During the first 2 minutes no loss of elastic properties is observed. Further pickling produces a sharp decrease in elastic properties of steel. No loss of elastic properties is observed when pickling in an uninhibited acid for the first 20 seconds, then comes a sharp decrease in elasticity of the metal.

3. In depositing thin layers of zinc, the application of ultrasonics reduces the duration of the process due to the use of higher current densities with the minimum loss of elastic properties.

In the formation of deposits 6 microns thick from cyanide electrolytes with the use of ultrasonics, the mechanical properties undergo relatively little change and approach the properties of springs electroplated from sulfate electrolytes. In zinc electroplating from acid solutions with the use of ultrasonics, the losses of elastic properties decrease, however, to a lesser degree than from cyanide electrolytes.

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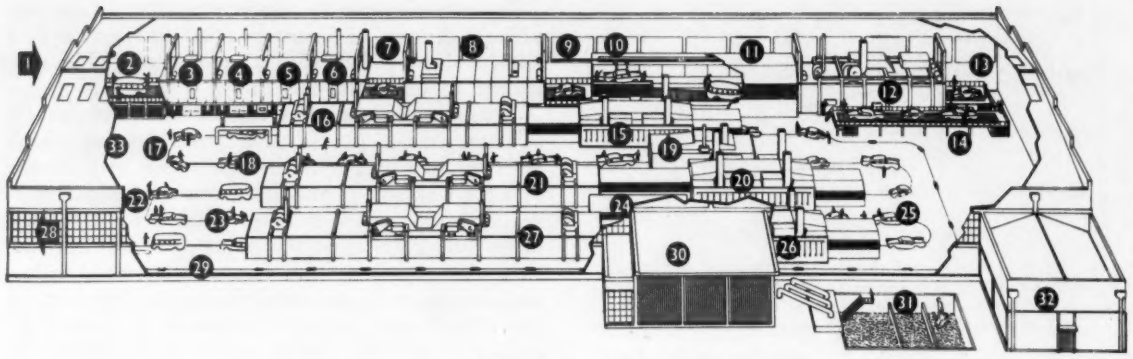


Fig. 1. Schematic View of Paint Shop.

Automated Paint Shop In South Africa

By Walter Sekules

PART of recent extensions carried out by South African Motor Assemblers and Distributors (SAMAD) was a paint shop which is claimed to set a new standard in car body finishing practice. Containing the largest paint dip tank in the Southern hemisphere. This plant is situated at Uitenhage. Volkswagen and Studebaker vehicles, received in the completely knocked down condition, are assembled here.

The diagrammatic sketch (Fig. 1) and the layout (Fig. 2) illustrate the flowline at Uitenhage. Fig. 3 shows the interior of the shop as seen from Point 33.

The car body is transferred from the body shop (1) in an adjoining building by means of an overhead conveyor. At (2) it is transferred to a twin flight bar conveyor with intermittent operation, the progress of which is regulated automatically at 4.8 minute intervals.

Measuring approximately 370 feet long, the phosphating and paint dip section comes next and is shown by Nos. 2 to 11 in the diagram. It is fully automatic except for the dipping operation when the body is fully immersed in the paint tank. This complete line is served by two intermittent flight bar conveyors, both of which are synchronized to work in conjunction with the doors and pumps of the phosphating plant and with the doors on the two ovens.

Each section in this line is divided into 20-foot stations, and bodies remain in each station for a period of 4.8 minutes before moving to the next station. The various compartments in this section are:

(2) Loading deck.
(3) Alkali degrease (spray) at 160°F.
(4) Cold rinse (spray).
(5) Spray phosphate at 140°F., shown in cross-section in Figure 4 and side elevation in Figure 5.
(6) Hot rinse with 1/20 per cent chromic acid at 130°F. (spray).
(7) Blow-off station.

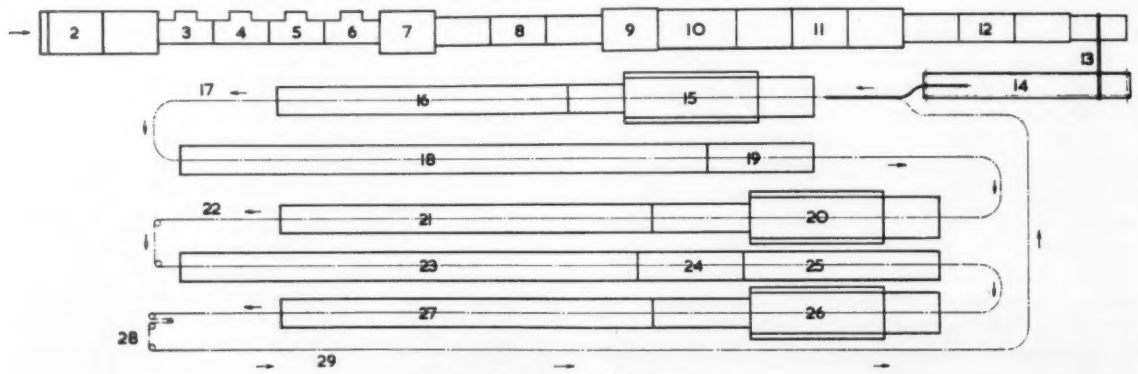


Fig. 2. Layout of Body Painting Line.

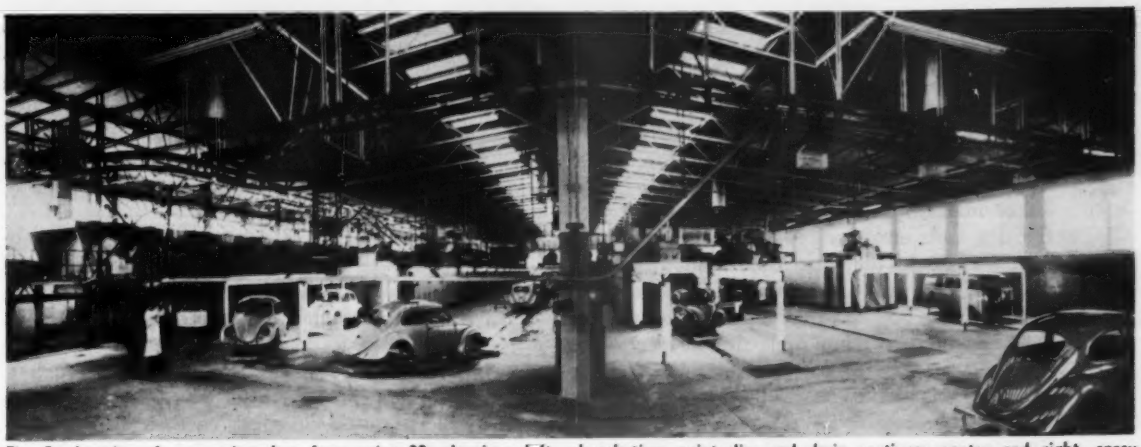


Fig. 3. Interior of new paint shop from point 33, showing: left, phosphating, paint dip, and drain sections; center and right, spray booths and baking ovens.

(8) Three stage indirect oil-fired dry-off oven.

(9) Transfer station where the body is lifted from the slat conveyor by means of an overhead air-operated hoist, ready for dropping into the prime paint dipping plant. In each section of the pretreatment unit, between the opening and closing of the doors, the pumps are in action for approximately 2½ minutes, and then stop, draining taking place until the doors open. The dry-off oven, approximately 60 feet long, is a three stage unit heated by air circulation, the heating medium being indirect fired heaters burning light diesel oil; oven temperature is maintained at up to 400°F.

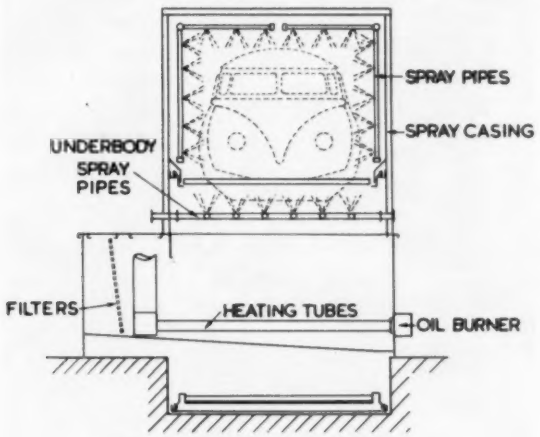


Fig. 4. Spray Phosphating Operation.

(10) *Prime dip tank (Figure 6)*

This is the only dip tank in South Africa exclusively used for the complete dipping of the car body shell. The tank is approximately 22 feet long by 9 feet deep by 8 feet wide. In normal operation it is filled with 9,000 gallons of paint. To make certain that there is no resettlement of the paint two recirculating pumps have been installed, one to stand by should the other one fail.

(11) *Three stage draining section*

When completely covered with paint the body shell is lifted from the tank and placed on the second slot conveyor; surplus paint runs off into the drain trays. This section, together with the dip tank area, is completely enclosed by means of a canopy constructed of steel sections, steel sheeting, and reinforced glazing to obtain as much natural light as possible. The object of the canopy is to confine the volatiles within this area. Filtered fresh air is supplied by an input fan, blanketing down air over the dip and drain section, and the heavy fumes are extracted by an exhaust fan connected to ducting running underneath the steel grid walkways on either side of the dip and drain section. As the above section represents a major fire hazard, two safety precau-

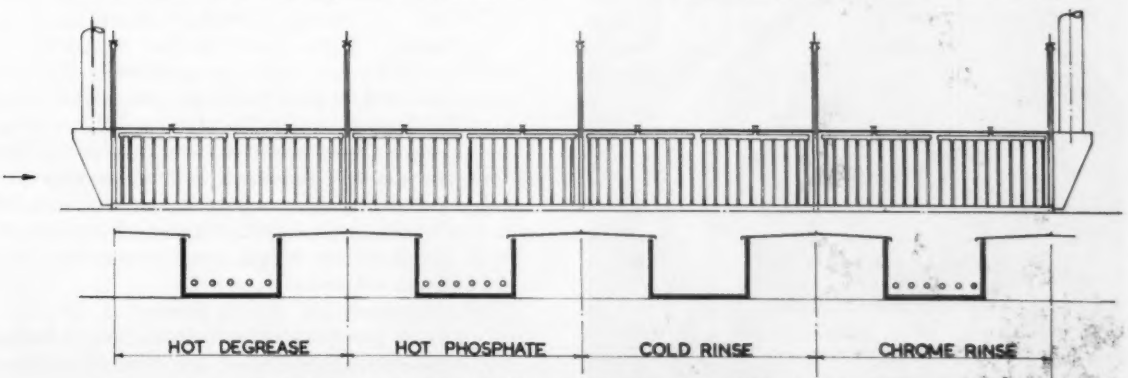


Fig. 5. Spray phosphating plant. Side elevation of spray phosphating operation.

tions have been taken. (a) A carbon dioxide distribution station has been installed over the whole dip and drain section, and (b) a paint dump tank, beneath the ground outside the paint shop but adjacent to the dip tank, has been installed. In the event of fire, the carbon dioxide is brought into commission, either manually or automatically, blanketing the dip tank and drain section with carbon dioxide gas. At the same time as the gas is released, two large valves are automatically opened in the bottom of the dip tank, draining the paint into the dump tank, thus preventing a serious fire and also saving the paint from excessive damage.

(12) *Primer bake oven*

This is a three stage oven, 60 feet long, heated by air circulation, the heating medium again being an indirect oil fired heater designed to burn light diesel oil. Vertical sliding doors are fitted to this oven, as on the phosphate and water dry-off ovens previously described.

(13) and (14) *High Level Conveyor*

When the body is delivered from the primer bake oven it is lifted by an air operated hoist onto a high level approximately 70 feet long and 7 feet high. Construction of this conveyor is similar to that of the slat conveyor running through the phosphating section. However, in this instance it runs continually at 5 feet per minute. The conveyor is situated at high level for easy access for the operator to apply a sound deadener and underbody sealer. From the high level conveyor the body is lifted by an air operated hoist and placed on the floor conveyor (29) which conveys the body through all subsequent operations, i.e. spray booths, baking ovens, flatting decks and inspection points. Figure 7 shows the shop viewed from near (14).

(15), (20) and (26) *Spray Booths*

There are three spray booths (cross-section fig. 8) each constructed in the same manner. Each booth has four extraction fans, capable of exhausting a total of 72,000 c.f.m. The exhaust air is scrubbed by water sprays in baffled ducting before being passed to atmosphere, ensuring that no paint fumes or overspray are thrown outside. Each spray booth has its own water pump, driven by a 75 h.p. motor, capable of delivering 2,000 gallons of water per minute. All three pumps are situated outside the paint shop.

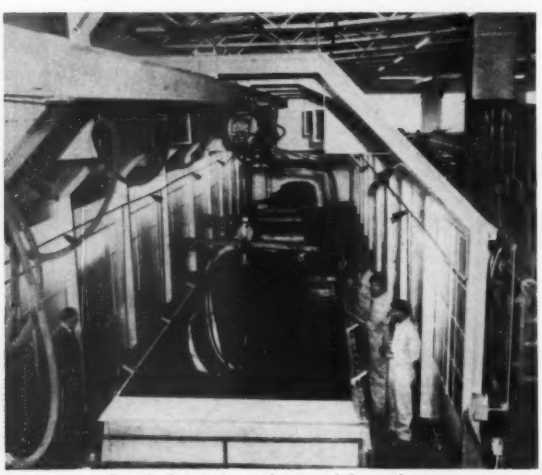


Fig. 6. Paint dip tank viewed from above.

(31) *Reinforced Concrete Tank*

Outside the paint shop a reinforced concrete tank with a capacity of 60,000 gallons of water has been constructed. Adjoining the tank, three pumps drive the water through 12 inch pipelines to the spray booths. The water then gravitates back to the tank through a common large diameter pipe. Overspray carried through the spray booth back to the recirculating tank is removed from the water by two banks of coke filters before the water is pumped back for further use. To replace all the air exhausted from these three booths, fans and filters have been installed in a separate building. These consist of (a) three input fans driven by 45 h.p. motors, each capable of delivering 80,000 c.f.m. and (b) three banks of electrostatic filters working at 20,000 volts which remove all dust particles from the air before it is delivered to the spray booths by means of large overhead ducts. Fabricated from light galvanized sheet metal these ducts are approximately 30 feet square in cross-section. A downward air flow is maintained over the car body being painted. The air passes through a grille and across the water surface to the baffle plates in the towers, where a water spray cleans it thoroughly. The air speed in the booth is approximately 120 feet per minute and, to maintain a state of plenum in the booth, the inlet of conditioned air is about 10 per cent greater than the booth extraction.

Fig. 7. Interior of paint shop from point 14. The high level conveyor on the right; center, bodies leave dry-off oven (19) and enter spray booth (20).

(16), (21) and (27) *Baking Ovens*

Three paint baking ovens have been installed immediately following the flash-off section. Each oven is over 100 feet long, and each

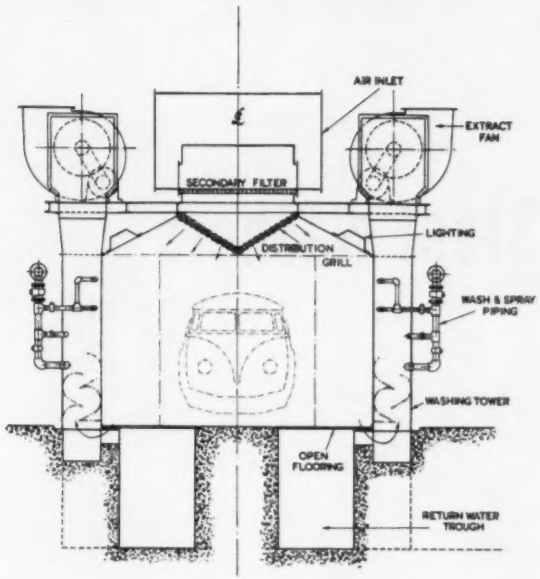


Fig. 8. Cross-Section of Spray Booth.

has two zones for heating, through which air is recirculated around the heat exchangers before entering the ovens. All three of these ovens are fitted with air seals at each end to prevent hot air from leaving the oven area and to keep cold air out. The fuel for the heat exchangers is light diesel oil.

(18) and (23) *Flatting Decks*
Two 40 feet long ovens (19) and (24) have been installed on the flatting decks for drying off any moisture that might be left on the body after the wet sanding operation. Both ovens are direct oil fired. As they are only drying off water, no heat exchangers or air seals are fitted.

(17) and (22) *Inspection Points*
Inspection points are located at (17) and (22) and at a point just before the body leaves the paint shop for the trim line (28). At these points, inspectors examine the body very carefully for blemishes; bodies which do not pass this inspection are returned to the appropriate section.

General Layout

The main building of the new paint shop covers an area of approximately 60,000 square feet and is separate from the main assembly buildings. Working in conjunction with the paint shop proper are a paint mix building (32), 1,600 square feet in area, and a paint store, also 1,600 square feet in area, which is situated approximately 300 feet away from the main building because of the highly volatile liquid stored in it.

Adjoining the paint shop is the air filtration building, of approximately 1,500 square feet in area. This building is used solely for housing equipment supplying clean air to the three body spray booths (15), (20) and (26). Between the filtration building and the paint mix building is the large open top concrete tank (31), previously described.

Main Building

The main building is constructed of reinforced concrete columns with brick and reinforced glazing between them. All windows are non-opening and the roof is completely sealed to ensure that no dust can enter. Ventilation is provided by ten input fans, complete with filter box, which are situated in the roof over the main working area. The air is ducted down to approximately 16 feet from the floor. Hot, foul air rises to the roof and escapes through an adjustable ridge ventilator which is 380 feet long.

A special ferrous salt was added to the top dressing of the concrete floor to prevent dust, caused by trolleys on the conveyor track, from rising. Not only does this prevent dust but, because the surface formed is very hard, it does away with the necessity for special guide tracks for the body trolleys.

Conveyor System

The paint shop is served by a system of conveyors which carry the body shell during the entire painting operation. An overhead conveyor (1) brings the body in from the finishing shop and returns carrying the finished painted body back to the trim line (28).

To carry the body conveyor, overhead tunnels were constructed between the main assembly building and the paint shop. There is also a light duty conveyor (33) to handle the small parts requiring painting. This small parts conveyor winds right through the main plant, beginning at the unboxing area adjoining the railway siding. Unpainted parts are loaded onto the conveyor, and are carried overhead to the paint shop where they are painted and loaded back onto the conveyor for distribution to the assembly lines. Approximately 1,800 feet long, this conveyor can be adjusted to run at speeds between 2 and 6 feet per minute by means of an electronic control panel situated within the paint shop.

The bodies are conveyed by means of two intermittent flight bar conveyors through the phosphating plant (3), (4), (5) and (6) and the paint drain and bake section (10), (11) and (12). The first conveyor operates between the loading platform (2) and platform (9) next to the paint dip tank. The second conveyor starts at the rear end of the paint dip tank (10) and runs to the transfer deck (13) at the end of the primer bake oven.

For convenience and ease of operation, there is a short overhead flight bar conveyor, carrying the car bodies through section (14) where the sound deadener and underbody sealers are applied.

To carry the body shells from the various spray booths, oven, flashing decks, etc., a single strand conveyor with an approximate overall length of 2,050 feet has been installed, with speed variable between 1½ and 5 feet per minute according to the rate of production flow required.

Measuring Loads For Steel Washers

By George Clayton Field, *Brookfield, Wisconsin*

THE chart for measuring surface area of washers and spacers is designed to give the total square feet per 1000, with only one scale reading. It is necessary to know the outside diameter, the inside dimaeter for the hole, and the thickness of the washer to be measured. This chart shows the cylindrical area of the outside diameter and area of both ends without holes as seen at scale (A) in square feet per M. This portion may be read by selecting the point where the diameter (diagonal line) intersects the perpendicular (thickness line) and then reading horizontally to the right, finding the sq.ft./M at line (A).

Having found the outside surface area as if without a hole, turn to the right hand graph and select the inside hole diameter (diagonal line) at the same thickness and read horizontally to the left and then read the plus or minus quantity of sq.ft./M on line (C). Lay the straightedge across from line (A) to line (C) and find the total square feet per 1000 pieces on line (B). However, it is not necessary to read the (A) and (C) scales at all but one may use the short cut explained in the following example.

Example: To find the surface area of a washer $\frac{1}{8}$" thick x $1\frac{1}{4}$" outside diameter x $\frac{1}{2}$" inside diameter. First, find the point where the $1\frac{1}{4}$" diagonal line intersects the $\frac{1}{8}$" perpendicular, thickness line in the left hand graph; then find the point in the right hand graph, where the $\frac{1}{2}$" diagonal line intersects the $\frac{1}{8}$" perpendicular, thickness line. Lay the straightedge across these two points and read 19 sq.ft./M on line (B). The lines (A) and (C) may be disregarded unless the outside diameter is to be considered singly for some purpose, then read as directed in the first explanation.

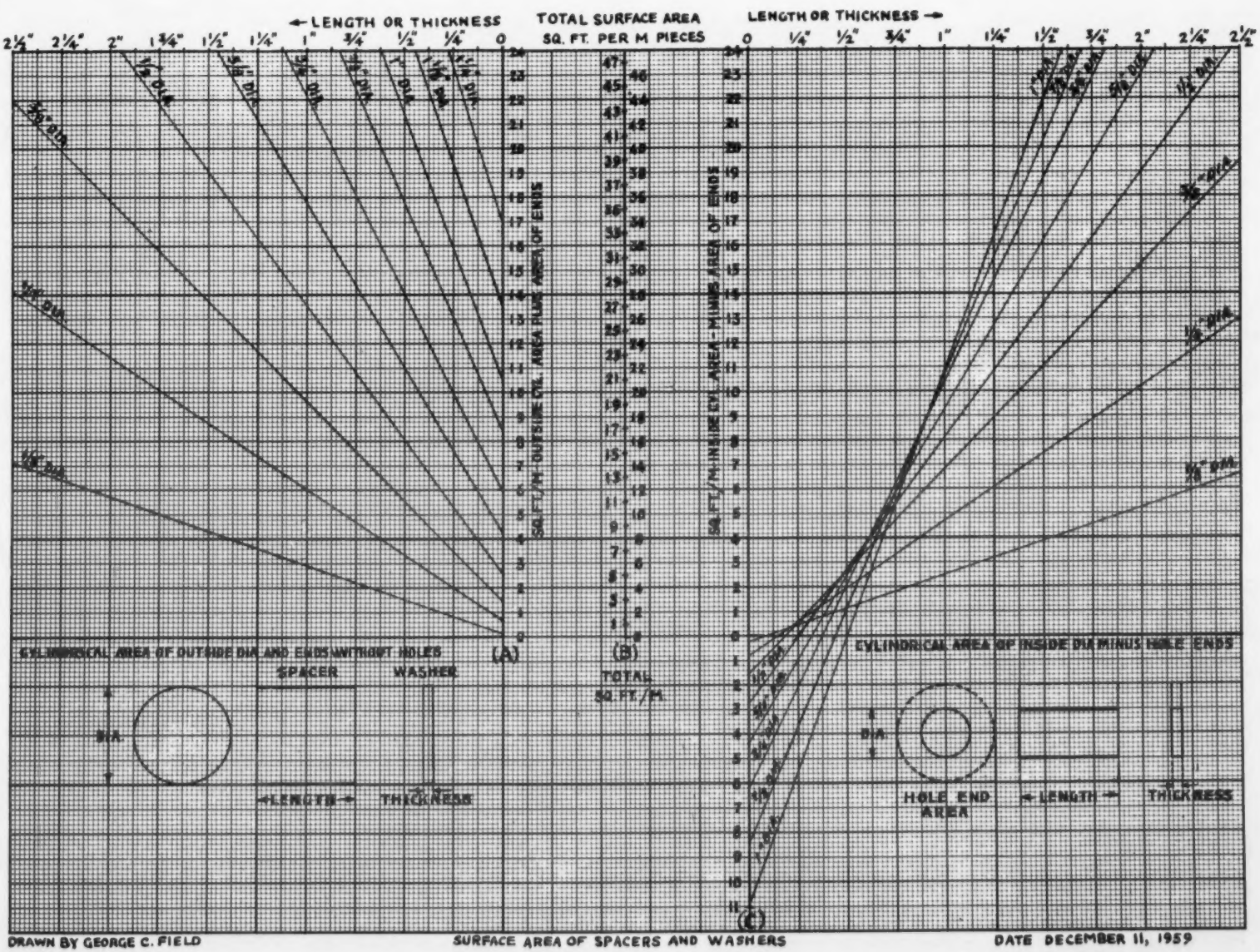
The chart on page 68 for measuring weight of washers is constructed on the same general principles as the area chart except it is in weight per 1000 pieces and there is no need to provide for addition. The purpose here is to subtract the weight of steel for the hole space from the solid body of the washer shown in scale (A). The example is as follows:

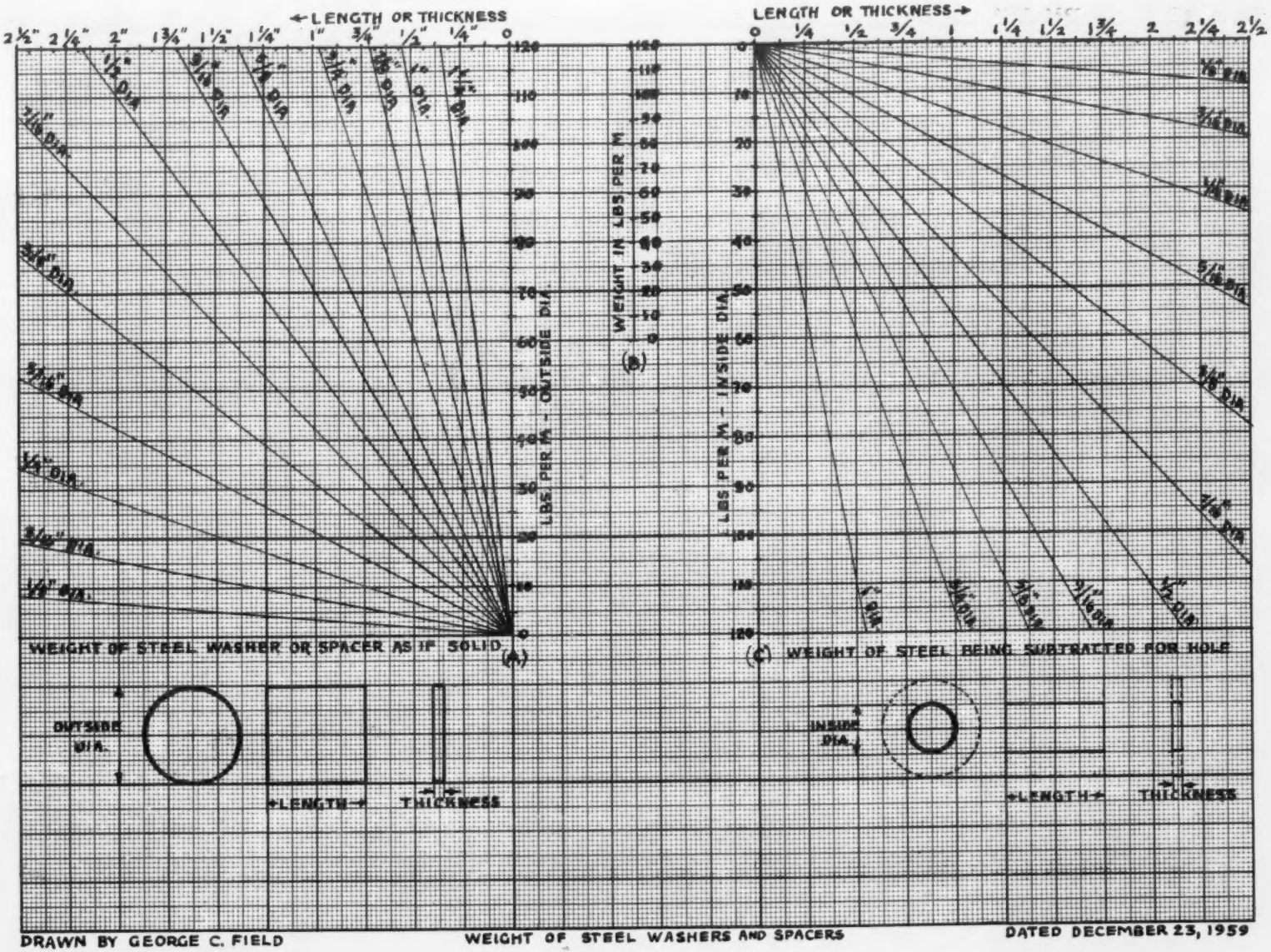
Example: To find the weight of $\frac{1}{8}$" thick x $1\frac{1}{4}$" outside diameter x $\frac{1}{2}$" inside diameter washer. First, find the point where the $1\frac{1}{4}$" diagonal line intersects the $\frac{1}{8}$" perpendicular line in the left hand graph; then find the point where the $\frac{1}{2}$" inside diameter line of the right hand graph intersects the $\frac{1}{8}$ perpendicular line. Lay the straight edge across these two points and read 36 lbs. per 1000 pieces on the center line (B). The lines (A) and (C) are not to be read when the straight edge is located from points in the body of the graphs. The results will be more accurate if a pencil point is held on the first point located, which will then provide a stop to hold the straight edge against until the point is located in the opposite graph.

These charts provide necessary data for measuring loads for all kinds of plating for horizontal barrels, automatic plating, tumbling, and dipping. The load capacity scales usually provided could not be included due to the peculiar construction of the charts. Those who would like to use the load capacity scales can make use of that portion of the charts published in previous issues of METAL FINISHING.

The area chart shown here is unique because of its flexibility. It adds or subtracts area, as required. If the area of the ends of the holes exceeds the cylindrical surface area, the number falls below the 0 line and it becomes a minus instead of a plus on the scale (C). Thus, the reversed numbers shown at the bottom of scale (C) will automatically result in the correct answer in scale (B).

As a note of caution, these charts should not be used for hair line accuracy. They are intended for determining loads for the plating room and are sufficiently accurate for that normal use. To get correct setting of points in both graphs, be sure to get the same length or thickness in each graph, using the right hand graph for hole measurement and the left hand graph for outer measurement. The answer found on line (B) will provide an approximate area or weight from which loads may be estimated. With a little practice the charts will be found an indispensable aid for plating to specifications and for estimating costs.


← LENGTH OR THICKNESS
TOTAL SURFACE AREA
SQ. FT. PER M PIECES
LENGTH OR THICKNESS →
SQ. FT./M. OUTSIDE CYL. AREA PLUS AREA OF ENDS
SQ. FT./M. INSIDE CYL. AREA - MINUS AREA OF ENDS
CYLINDRICAL AREA OF OUTSIDE DIA AND ENDS WITHOUT HOLES
SPACER
WASHER
DIA.
← LENGTH →
THICKNESS
(A)
(B)
TOTAL SQ. FT./M.
CYLINDRICAL AREA OF INSIDE DIA MINUS HOLE ENDS
HOLE END AREA
(C)
DRAWN BY GEORGE C. FIELD
SURFACE AREA OF SPACERS AND WASHERS
DATE DECEMBER 11, 1959


← LENGTH OR THICKNESS
2½" 2¼" 2" 1¾" 1½" 1¼" 1" ¾" ½" ¼" 0
LBS PER M. - OUTSIDE DIA.
WEIGHT IN LBS PER M.
LBS PER M. - INSIDE DIA.
LENGTH OR THICKNESS →
0 ¼ ½ ¾ 1 1¼ 1½ 1¾ 2 2¼ 2½
WEIGHT OF STEEL WASHER OR SPACER AS IF SOLID. (A)
OUTSIDE DIA.
← LENGTH →
THICKNESS
(C) WEIGHT OF STEEL BEING SUBTRACTED FOR HOLE
INSIDE DIA.
← LENGTH →
THICKNESS
DRAWN BY GEORGE C. FIELD
WEIGHT OF STEEL WASHERS AND SPACERS
DATED DECEMBER 23, 1959

Science for Electroplaters

58. Adhesion

By L. Serota

ELECTROLYTIC deposition of a metal on another metal (basis metal) serves to produce a surface showing properties superior to those exhibited by the basis metal. Adhesion, appearance, and resistance to corrosion are some examples of important properties of the plated surface commonly required.

Adhesion is considered important, since the firmness of adhesion of the deposited metal to the basis determines whether or not the coating will be detached when a stress is applied, resulting from mechanical processes, escape of occluded gases, temperature changes, or corrosion through fine pores. An adherent coating, A. Brenner and V. D. Morgan note, will provide better protection for the basis metal against corrosion, since corrosion through scratches, or imperfections in the coating, cannot spread rapidly between the adherent deposit and the basis metal.

The increasing use of electrodeposits for such purposes as the building up of worn (machine) parts by iron, chromium, and nickel, or the development of electrodeposited metals for bearings, has further emphasized the need to consider adhesion a primary requisite in electroplating.

The term adhesion, A. W. Hothersall states, represents the force required to effect separation of the coating at or near its junction with the basis metal. The forces involved in adhesion are atomic in nature. Deposition of metals with relatively high tensile properties, such as nickel, Hothersall indicates, require high adhesion, since such metals tend to transmit stress to a weak junction more readily than deposits of metals such as zinc, cadmium, and tin, which are deformed more readily. Examples of adhesion values, obtained by Hothersall, for electrodeposited nickel on various metals, are shown in Table 1. Results are based upon the Ollard type test.

An example of this difference in degree of adhesion for various metals was given by W. Blum in the discussion following the presentation of the paper on adhesion by Hothersall. Nickel plated over a thin layer of zinc or cadmium on steel peeled readily, but a film of the zinc or cadmium remained on both the nickel and steel. This, Blum notes, represents perfect adhesion even though the apparent adhesion was poor, since fracture occurred in the under-coat.

Peeling in service of decorative coatings is considered unlikely according to Hothersall, if the deposits will withstand stresses due to the plating process or subsequent polishing steps. The term adherent deposit, he contends, merely indicates that the deposit did not separate under the conditions studied. It may not apply to other tests or uses. A. L. Ferguson and E. F. Stephan, in their comprehensive survey of adhesion of electrodeposits, express the view that the two important factors in the study of adhesion are the methods employed for securing adhesion and the methods of measurement.

B. F. Lewis considers the standards of adhesion in electrodeposits to be similar to those in welding of metals, in that the junction of the two metals must be as strong or stronger than the metals which are joined.

B. F. Hammond, in discussing the adhesion requirements for thick nickel deposits used in the repair of worn parts (engineering purpose) stressed the importance of perfect adhesion. This meant, he implied, that the strength of the bond at the interface should be greater than the tensile strength of either the basis metal or the deposit. For example, Hammond found that, when nickel was plated on mild steel, rolled bar, or on 3 per cent forged nickel steel, fracture occurred in the steel at 25 tons/in.^{2} and 32 tons/in.^{2} respectively and, with nickel plated on 70/30 brass, fracture was located in the brass at 23.5 tons/in.^{2}

The distinguishing terms "ideal adhesion" and "practical adhesion" are suggested by E. H. Lyons. The term ideal adhesion is proposed, for example, where atomic bonding provides adhesion, and the term practical adhesion for cases where adhesion for the plated surface is sufficiently strong to withstand all services and inspection requirements.

C. L. Faust, as a means of clarification, prefers to distinguish between "adhesive" and "bond" strength. The term adhesive strength is suggested to designate the force required to separate the electrodeposit at the interface between the plate and the basis steel. The term bond strength, by this grouping, would represent a value which would be measured by the force re-

TABLE 1.

Typical Adhesion Values for Electrodeposited Nickel on Various Metals.*

Metal	Condition	Typical adhesion values lb./sq. inch	Location of fracture
Mild Steel	Rolled bar	63,000	In steel
Nickel Steel	Forged	72,000	In steel
Copper	Extruded rod	41,500	In copper
Brass 70:30	" "	53,000	In brass
60:40	" "	43,000	In brass
Aluminium	" "	8,000	In aluminium
Tin	Melted film	3,960	In tin
Lead	Electrodeposited film on steel	2,470	In lead

**All specimens tested as deposited without subsequent low temperature treatment.*

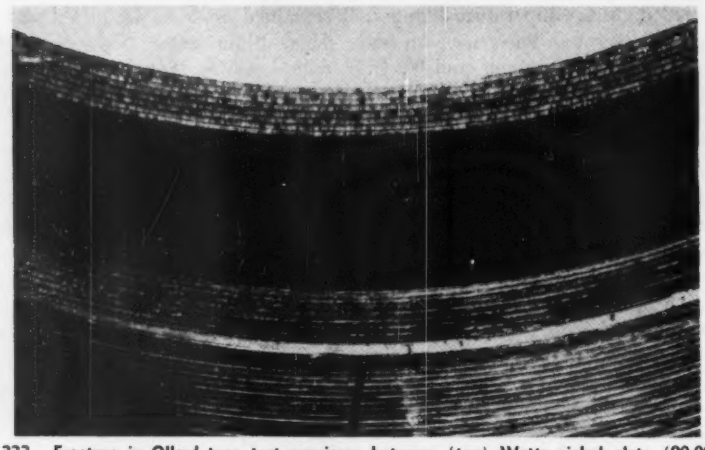


Fig. 222. Fracture in Ollard-type test specimen between (top) Watts-nickel plate (90,000 psi strength) and (bottom) steel (100,000 psi strength in Ollard tensile test). Sharp fracture occurred at 25,000 psi, the steel having intentionally been poorly cleaned. 13X

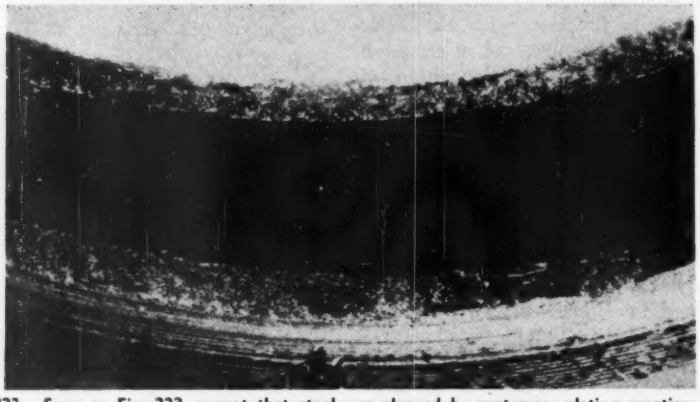


Fig. 223. Same as Fig. 222, except that steel was cleaned by customary plating practice which does not remove worked metal skin from steel surface. Fracture occurred at 35,000 psi entirely in steel surface layer, seen attached to nickel plate (top). 13X

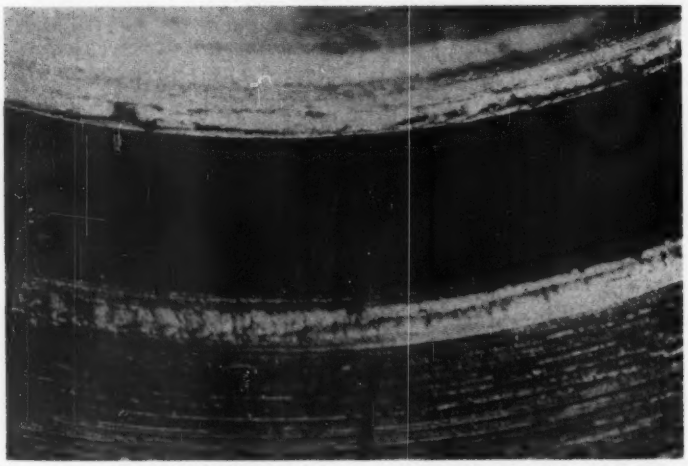


Fig. 224. Same as Fig. 222 and 223 except that machined steel surface had been removed prior to plating. Fracture was ductile and occurred at 90,000 psi in nickel plate, part of which entirely covers steel surface (bottom). 13X

quired to separate the plate from the basis metal regardless of the place of fracture.

The proposed terms are supported by photomicrographs which Faust made of Ollard test specimens of nickel plated steel. The surface conditions of the steel was evaluated in terms of the tensile strength of the adhesion of the plated (Watt's) nickel. Fig. 222 is an example of poor adhesion of a specimen of nickel plated on improperly cleaned and machined SAE 1010 steel. The steel was just vapor degreased before being placed into the plating tank. Clean separation (fracture) occurred at 25,000 psi at the interface between the nickel plate and the basis metal (steel) even though the tensile strength of the nickel plate was 90,000 psi and that of the steel, 100,000 psi.

In Fig. 223 the two halves of an Ollard test specimen are shown for the same plating operation as that of the sample in Fig. 222. The steel for this plating process was cleaned by the customary practice. The worked metal skin was not removed from the steel surface, however. Fracture occurred at 35,000 psi in the steel surface layer. The surface layer of the steel, Faust notes, was weaker than the basis metal and nickel plate which, in his opinion, is an example of perfect adhesion but low bond strength.

When the machined layer of the SAE 1010 steel was removed by polishing before proceeding with the usual cleaning process prior to plating, fracture occurred at 90,000 psi entirely in the plated nickel layer. Fig. 224 is an indication of perfect adhesion and maximum bond strength.

These tests, Faust contends, emphasize the distinction in terms suggested. Failure, for example, in Fig. 222, where separation occurs under high stress between the nickel and basis metal, is due directly to the improperly cleaned surface. The nickel plate, as he expresses it, did not "stick." Failure, as in Fig. 223, however, differs from that in Fig. 222, since the plate did not adhere to the surface skin of the basis metal. Fracture occurred within the surface skin itself. Maximum strength was demonstrated by results in Fig. 224. Thus the term adhesion may be applied to the condition encountered in Fig. 222, and the term bond strength for failures resulting in cases shown in Fig. 223 and 224. The latter two examples, it is noted, are indicated as instances of metallurgical faults and, therefore, are not related to the plating process. In effect, adhesion, Faust contends, is the physiochemical concern of inter- and intracrystalline forces, bond strength a mechanical property.

During the discussion period following the presentation of the paper relating to Figs. 222-4, Faust emphasized the fact that adhesion failure in these tests was due entirely to mechanical damage of the steel surface. Care was taken to eliminate hydrogen embrittlement as a contributory factor.

(To be continued)

SHOP PROBLEMS

BARREL FINISHING — POLISHING AND BUFFING
CLEANING — ANODIZING — ELECTROPLATING
RUSTPROOFING — LACQUERING AND ENAMELING

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Plating on Tantalum

Question: One of our engineers is interested in plating tin-lead alloy (which we do) onto tantalum (which we have never done). Do you have any informaton on plating to tantalum? Standard references are silent on this score.

I. W. M.

Answer: Two methods have been reported in the literature for pretreating tantalum for plating.

Huddle & Flint (U. S. Pat. #2,835,-630. May 20, 1958) suggested shot blasting with ferrous metal shot, followed by an immersion copper deposit, after which the desired electrodeposit is applied.

Saubestre (J. Electrochem. Soc., *106*, 305. 1959) suggested soak alkaline cleaning, followed by anodic treatment in 10% wt. hydrofluoric acid at 50 amp./sq. ft. if the surface is an old one. After the usual rinse, the part is treated cathodically for 5-15 seconds at 10-100 amp./sq. ft. and room temperature in a 2% wt. solution of hydrochloric, sulfuric, nitric or hydrofluoric acid, or in caustic soda or caustic potash, using an insert anode. Rinse and nickel strike for ½-2 minutes in the following solution, after which the tantalum is plated as desired:

Nickel sulfate ..... 300 g./l.
Nickel chloride ..... 37½ "
Boric acid ..... 37½ "
pH: 4
Temp. 65°C.
C. D. 5-100 amp./sq. ft.

The cathodic treatment improves adhesion possibly due to the formation of surface hydride as a result of hydrogen adsorption.

Salt Spray Resistance of Anodized Aluminum

Question: In your METAL FINISHING GUIDEBOOK (1960) you published under "Chemical Conversion Coatings," on page 523, some salt spray data for chromates on aluminum. We wonder whether you would be able to give us the corresponding salt spray data for the same alloys anodized under the following conditions:

15% Sulphuric acid solution
70°F.
30 minutes
12 volts

Your information would help us make a positive decision in one of our production problems.

P. V.

Answer: We would not expect a very thick film of oxide with an anodizing voltage of only 12. Specification MIL-A-8624(ASG) requires a salt spray resistance of 240 hours. This is usually obtained by anodizing for ¼ hr. at about 12-15 amp./sq. ft. (14-18 volts) and sealing properly.

We are not aware of any table which compares salt spray resistance of aluminum alloys which have been anodized under any particular conditions; however, some interesting data will be found in the book, "Surface Treatment of Aluminum" by Wernick and Pinner.

Hamilton Gold

Question: We have met with some controversy in connection with the gold shade known as "Hamilton Gold." The Jeweler's Dictionary, published by the Chilton Co., defines "Hamilton Metal" as a brass alloy made of equal parts of copper and zinc, and used as an imitation gold. Is it possible to plate a true Hamilton color and still maintain an 18K alloy?

S. H. L.

Answer: Hamilton gold is a shade closely resembling yellow brass, although we have noted from time to time that shades similar to 14K were also called by this name. Therefore, the plater must be given a standard sample by the customer so that he can match it.

Practically all karat shades of gold electroplate will assay about 21-23K even though the color may resemble 10 or 14K metal. It has been claimed, however, that the new acid gold baths can produce lower gold content deposits.

Eliminating Orange Peel

Question: Ever since we have changed to another color of enamel we have been experiencing a large amount of "orange peel" after spraying. We are using filtered air and a pressure pot. The paint supplier tells us that the only difference our present enamel has from our former one is in color. How can we eliminate the "orange peel" we are experiencing?

C. T. H.

Answer: The most common causes for orange peel center around air and/or fluid pressure. Try increasing the fluid pressure. If the problem continues to exist, reduce the air pressure until just before poor atomization begins. If neither of the above suggestions proves to be a solution to the problem, try thinning the enamel. First thin it with the presently used solvent and, if poor coverage occurs, use a slower solvent.

Phosphate vs. Chromate Conversion Coating on Aluminum

Question: For a number of years one of our specifications has called for a phosphate coating on aluminum and stipulated a certain proprietary material. The problems involved with this product finally came to a head about a year ago and even repeated efforts by the supplier failed in obtaining a consistant and satisfactory bond to paint.

Since this time our finishing section and factory laboratory have attempted to convince our engineering section of the superiority of a chromate coating. The application of a proprietary chromate coating has proved highly satisfactory in our experience.

If you would send me some of your reasons for selecting phosphate coatings over chromate coatings I would greatly appreciate it. How else could adhesion be increased on aluminum?

G. S.

Answer: In our opinion, neither the phosphate nor the chromate conversion coating of aluminum are significantly superior to one another (adhesion-wise) as a basis for an air drying organic coating. As a basis for a baking organic coating, the phosphate film is generally superior to the chromate. For superior adhesion of organic coating to aluminum, sulfuric acid anodize followed by a partially seal (5 minutes) in chromic acid should be considered if the adhesion requirements are severe and the situation economically warrants it.

We feel that even better than the anodized material, a wash primer may also be indicated. This organic film which is mixed prior to applying by spraying, usually dries in less than 15 minutes and may be used both for air drying and baking organic films.

Based on some scratch adhesion testing data, we would give one weak vote for phosphate films over chromate for air drying organic coatings.

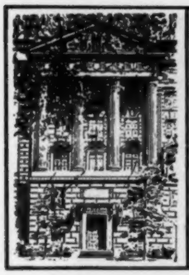
Chromium Hardness

Question: Recent tests by a customer on a piece of shafting to which we had applied hard chrome gave a Brinell reading of 280 to 300, the shafting tested over 450 which was the capacity of the testing equipment. Also, the shafting tested 60 Rockwell C while the hard chromium plating tested 34-35 Rockwell C. The customer desired hard chrome plating with 80 hardness on Rockwell C scale.

We would very much appreciate any information you may be able to give us on hard chrome plating, especially on how to achieve the hardness figures that seem to be expected as normal.

A. F. T.

Answer: It is possible to obtain chromium deposits with a hardness as low as 300 Brinell by modification of the solution and operating conditions. However, the standard 33 oz. bath with a ratio of 100:1, at 130°F. and 300 amp./sq.ft., should produce hardness figures above 700 Brinell. In general, deposits in the bright range are much harder than dull deposits.



Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Maintenance of Conversion Coating Bath

U. S. Patent 2,909,455. *Oct.* 20, 1959.
N. J. Newhard, Jr. and D. Y. Dollman, assignors to Amchem Products, Inc.

In the art of coating a series of aluminum pieces wherein the surfaces thereof are treated successively with an aqueous acid bath the coating producing ingredients of which consist essentially of fluoride, hexavalent chromium, phosphate and hydrogen ions; the method of controlling the composition of the bath which comprises constantly withdrawing a portion of the bath, passing it through a cation exchange resin and returning it to the bath; maintaining the fluoride activity of the bath by periodically adding thereto at least 1 mol of sodium fluoride and 2 mols of potassium fluoride for each mol of aluminum dissolved in the bath; and maintaining the hexavalent chromium, the phosphate and the hydrogen ion content by suitable additions as may be required.

Vacuum Metalizing

U. S. Patent 2,910,039. *Oct.* 27, 1959.
P. W. Patton and R. H. Kelly, assignors to National Research Corp.

Apparatus for coating a substrate with selenium by vapor deposition techniques.

Brighteners for Electroplating Baths

U. S. Patent 2,910,413. *Oct.* 27, 1959.
W. Strauss and H. Wedell, assignors to Dehydag, Deutsche Hydrierwerke G.m.b.H.

An electroplating bath for producing bright deposits of metals selected from the group consisting of copper, zinc, silver, nickel, cadmium, bronze and brass comprising an aqueous acid solution of an inorganic salt of the metal to be deposited and from about 0.01 to about 20 grams/liter of an acyclic organic compound having the general structural formula

$$Q{-}X{-}\underset{\underset{\textstyle Y}{\|}}{C}{-}Z{-}R{-}Z'{-}\underset{\underset{\textstyle Y'}{\|}}{C}{-}X'{-}Q'$$

wherein R is a lower aliphatic radical, Q and Q′ are selected from the group consisting of hydrogen, lower alkyl and lower hydroxy-alkyl, X, Y and Z are selected from the group consisting of oxygen, sulfur, nitrogen and the imino radical, and X′, Y′ and Z′ are selected from the group consisting of oxygen, sulfur, nitrogen and the imino radical.

Gas Plating

U. S. Patent 2,910,382. *Oct.* 27, 1959.
P. Vulliez

A method of formation of a surface alloy coating by diffusion in the gaseous phase of a coating-metal, in which the metallic articles to be coated are heated in a reducing furnace in the vicinity of the coating-metal and in the presence of a halide, the said coating-metal being constituted by at least one element which has previously been sintered to a porous state.

Grit Blasting

U. S. Patent 2,910,812. *Nov.* 3, 1959.
A. J. Brunner, assignor to Western Electric Co., Inc.

The method of blasting with walnut shell grit comprising continuously dropping such grit in a sheet along a predetermined path, continuously directing a mist of steam condensate at a temperature of about 170°F. on the sheet of walnut shell grit to impregnate the walnut shell grit with steam condensate to cause the shell grit to swell, and removing the swelled moistened grit and blasting it against articles to be cleaned.

Rust Preventive

U. S. Patent 2,911,309. *Nov.* 3, 1959.
H. W. Rudel and W. Seitz, assignors to Esso Research and Engineering Co.

A rust inhibiting water displacing composition consisting essentially of a major proportion of a mineral oil, an oil soluble rust preventive in amounts of about 0.5 to 30 parts by weight of total composition selected from the group consisting of C_{12} to C_{22} fatty acid partial esters of aliphatic polyhydric alcohols having about 3 to 12 carbon atoms, alkali and alkaline earth metal salts of petroleum sulphonic acids, and alkyl aryl sulphonic acids having average molecular weights of about 350 to 520, and a water displacing agent in amounts of about 0.1 to 10 parts by weight of total composition having the formula:

$$RCOO(R'O)_nR''$$

Continuous Strip Plating

U. S. Patent 2,910,422. *Oct.* 27, 1959.
K. Egge, assignor to U. S. Steel Corp.

In apparatus for continuously electroplating strip, means for supporting said strip for movement in a vertical path, a series of elongated vertically disposed anode bars supported for movement transversely of the strip, said series of anode bars being mounted adjacent the strip and extending across the width thereof, each of said anode bars having a projection at one vertical edge and a recess at the other vertical edge, the vertical projection of one anode bar being received in the vertical recess of the adjacent anode bar.

Chromate Coating

U. S. Patent 2,911,332. *Nov.* 3, 1959.
L. K. Schuster and A. L. Baldi, Jr., assignors to Kelsey-Hayes Co.

A method for treating a non-ferrous metal surface comprising the steps of coating the surface with an aqueous solution consisting essentially of water, chromic acid and a compatible reducing agent for the chromic acid, said reducing agent being compatible with the chromic acid for at least one day at 80°F., and heating the coated surface to a temperature of from 250 to 500 degrees F. to cause the reducing agent to react with the chromic acid and leave a water-insoluble layer, the proportions of reducing agent and chromic acid being such that from about 40 to 95% of the chromium in the chromic acid is reduced to trivalent form, and the final layer weighs at least about 3 milligrams per square foot of surface.

Aluminum-Containing Coating

U. S. Patent 2,911,341. *Nov.* 3, 1959. *R. F. Linden, assignor to Major Engineering Corp.*

The process of electroplating an aluminum-containing coating onto a metallic surface which comprises making the surface the cathode and passing a unidirectional current through an aqueous solution containing at least 15 grams per liter of aluminum sulfate and at least one salt selected from the group consisting of the alkali metal sulfates, the alkaline earth metal sulfates and ammonium sulfate in sufficient quantity to provide at least a 10% excess of sulfate ions over that contributed by the aluminum sulfate, with an essentially pure aluminum anode and maintaining the solution within the pH range of 3.5 to 4.5.

Plating Conveyor

U. S. Patent 2,911,345. *Nov.* 3, 1959. *T. J. Swenson, assignor to Corning Glass Works*

In an electroplating system, a horizontally disposed article support rotatable for conveying articles to be plated through a plating solution and comprising the cathode of the system, a fixed spiral fence arranged coaxially with respect to the axis of said support immediately above said support, an anode overlaying said fence, and means for rotating said support whereby an article arranged on said support between adjacent convolutions of said fence will be urged thereby transversely of said support as it is rotated.

Plating Rack

U. S. Patent 2,911,347. *Nov.* 3, 1959. *E. R. Gutzmer, assignor to Intercompany Corp.*

A frame adapted to be suspended in a vertical plane and providing a plurality of surfaces disposed in a common plane and against which a ferrous metal plate may be located in a working position.

Degreasing Solvent

U. S. Patent 2,911,371. *Nov.* 3, 1959. *G. E. Weis, assignor to Standard Oil Co.*

In a process for cleaning metal surfaces which have been contaminated by tarry or resinous products such as crude oil, fuel oil, asphalt and other petroleum residual products, the step of washing the metal surface at eleva-

ted temperature with a distillate non-viscous hydrocarbon fraction which contains an additive combination essentially consisting of about 0.2 to 2.0 weight per cent of a detergent-dispersant consisting of a non-gaseous hydrocarbon which has been reacted with a phosphorus sulfide and thereafter has been neutralized with a basic reagent selected from the class consisting of basic compounds of alkali and alkaline earth metals and about 0.4 to 1.0 weight per cent of an N-alkyl propylene diamine.

Automatic Plater

U. S. Patent 2,912,094. *Nov.* 10, 1959. *J. V. Davis, assignor to The Udylite Corp.*

A conveying apparatus having straight rail sections and an arcuate turn-around rail section joining said straight rail sections, and means for advancing work carriers along said straight rail sections.

Hot Dip Coating

U. S. Patent 2,912,346. *Nov.* 10, 1959. *J. J. Kanter, assignor to Crane Co.*

The process for coating ferrous metal articles with magnesium and magnesium-base alloys which comprises enveloping a surface of said ferrous article with an atmosphere of an inert element, said surface having a thin coating of metal soluble in magnesium and suitable for coating ferrous metals, and contacting said surface of said article with a coating metal selected from the class consisting of magnesium and magnesium-base alloys in the molten phase for a period of time sufficient to permit said molten coating metal to dissolve said thin coating of said metal soluble in magnesium metal and wet the surface of said ferrous article.

Electroforming

U. S. Patent 2,912,368. *Nov.* 10, 1959. *G. H. Bingham, Jr., assignor to Cambridge Rubber Co.*

A method of making metal lasts.

Plating Slide Fasteners

U. S. Patent 2,911,346. *Nov.* 3, 1959. *C. C. Cohn, assignor to Samuel L. Cohn and Charles C. Cohn*

Apparatus for the electrolytic treatment of a closed slide fastener having metallic interengaging slide fastener elements secured to fabric tapes.

Cadmium Brightener

U. S. Patent 2,912,370. *Nov.* 10, 1959. *A. R. Taverna, assignor to Allied Research Products, Inc.*

A cadmium cyanide plating bath containing a mixture of dibutyl naphthalene sodium sulfonate and hydroxyethyl cellulose in an amount sufficient to act as a brightening agent, wherein the bath contains ¾ fluid ounce per gallon of bath of the brightener mixture, wherein said brightener mixture contains from 0.152 to 0.557 gram per liter of the dibutyl naphthalene sodium sulfonate and from 0.049 to 0.279 gram per liter of hydroxyethyl cellulose and the ratio of dibutyl naphthalene sodium sulfonate to hydroxyethyl cellulose is in the range from the ratio 1.0 to 2.0 to the ratio 3.75 to 1.

Ceramic Coating

U. S. Patent 2,912,751. *Nov.* 17, 1959. *F. W. Turnbull*

A method of lining a metal tube with an adherent coating of ceramic material comprising the steps of covering a mandrel with a sheet of foil, fusing a ceramic coating onto said foil, introducing the mandrel with its coated foil cover into the tube to be lined, heating the assemblage, sinking the tube progressively onto the coating, and thereafter removing the mandrel.

Barrel Finishing

U. S. Patent 2,912,800. *Nov.* 17, 1959. *R. J. Smith-Gorman, assignor to Rolls-Royce Ltd.*

Tumbling apparatus comprising a plurality of tubes disposed one above the other in a bank with their longitudinal axes horizontally extending, each said tube having an inlet end and an outlet end and each tube having its outlet end adjacent the inlet end of the tube next below it, each said tube being adapted to cause travel of articles, which are to be polished or de-burred, from its inlet end towards its outlet end.

Abrasive Polishing

U. S. Patent 2,912,804. *Nov.* 17, 1959. *L. G. Simjian*

A method for polishing an article comprising; coating the surface of the article to be polished with an adhering layer of abrasive particles; exposing the coated surface to sonic energy to free the surface of said particles thereby causing the particles to abrade the surface as they become displaced therefrom.

Barrel Finishing

U. S. Patent 2,912,803. *Nov.* 17, 1959. *L. G. Simjian*

A method of abrading an article within a flexible container comprising the steps of placing the article to be abraded and loose abrasive particles in a sealed container having a partially flexible enclosure, loosely disposing said flexible container in a receptacle, applying a differential pressure between the inside and the outside of said sealed container and agitating said receptacle to cause motion between the receptacle and the sealed container and to cause the container enclosure to become repetitively distorted.

Plating Machine

U. S. Patent 2,912,989. *Nov.* 17, 1959. *D. J. Borodin, assignor to Wagner Brothers, Inc.*

In a plating machine, the combination comprising a support, a row of plating tanks extending along said support, a carriage mounted on said support for reciprocation along said row of plating tanks, and means mounted on said carriage for movement longitudinally thereof.

Electrostatic Spraying

U. S. Patent 2,913,186. *Nov.* 17, 1959. *J. Sedlacsik, Jr.*

An electrostatic coating device adapted to electrostatically charge a spray of coating material.

Organic Coating

U. S. Patent 2,913,348. *Nov.* 17, 1959. *J. Jackson, assignor to E. I. du Pont de Nemours & Co.*

A coating composition comprising an organic film-forming material and basic nickel carbonate in a minor amount sufficient to impart durability to the coating composition.

Method of Descaling Nickel Alloys

U. S. Patent 2,913,360. *Nov.* 17, 1959. *D. R. Zaremski and J. M. Beigay, assignors to Allegheny Ludlum Steel Corp.*

The method of treating a scaled metal article formed from a nickel base alloy which comprises, contacting the surface of said article with an aqueous bath that contains from about 5% to about 30%, by weight, acetic acid,

about .5% to 17%, by weight, hydrofluoric acid and about 0.1% to 2% titanium.

Spray Gun

U. S. Patent 2,913,187. *Nov.* 17, 1959.
D. F. Anderson

A spray gun construction adapted for the pressure controlled spraying of viscous liquids.

Analytical Electroplating Cell

U. S. Patent 2,913,375. *Nov.* 17, 1959.
R. Gilmont

The method of simultaneously determining the comparative appearance of the electrodeposit obtainable from the same plating bath under differing current densities and in a single plating operation, which method comprises passing an electric current from an anode through a confined body of the plating bath to a cathode while the bath is confined at its bottom and confined on two sides by intersecting vertical flat straight boundary planes that form an acute included angle and are positioned relative to one another so that one such side is represented by the analytical equation y equals zero while the other of them corresponds to the equation x equals y; and then having its confinement completed on two other sides by a curved boundary plane for each of them, such that both of these two curved boundary planes are hyperbolically curved in horizontal cross-section with their inner surfaces corresponding respectively to the equations $x^2 - y^2$ equals L^2, and xy equals one-half of r^2L^2, wherein L is the length of one of the two straight planes, and r is the ratio between the respective lengths of the two straight sides; and the two curved planes are segments of hyperbolic cylinders and orthogonal to each other at their junction and each of them is orthogonal to its respectively adjacent straight planes and asymptotic to the other; one of the electrodes providing one of the straight planes, and the other electrode providing the curved plane positioned opposite to the first electrode.

Bright Copper Bath

U. S. Patent 2,913,376. *Nov.* 17, 1959.
H. G. McLeod, assignor to E. I. du Pont de Nemours & Co.

In the process of electrodepositing copper from an aqueous alkaline copper cyanide plating bath containing selenium additives, the step of adding potassium bromate to said bath in an amount sufficient to maintain the selenide ion concentration within the range of 0.1-0.01 p.p.m.

Anodizing Spray Depressant

U. S. Patent 2,913,377. *Nov.* 17, 1959.
H. Brown, assignor to The Udylite Research Corp.

In an anodizing process employing essentially insoluble anodes selected from the group consisting of aluminum, manganese and lead and an aqueous solution of an acid selected from the group consisting of sulfuric, phosphoric, and oxalic acids, the improvement comprising minimizing the formation of spray and mist during anodizing by incorporating in said aqueous electrolyte a perfluoro-alkane sulfonic acid of 6-10 carbon atoms inclusive in a quantity to produce therein a concentration of about 0.003 to 6 grams/liter.

Buffing Wheel

U. S. Patent 2,913,856. *Nov.* 24. 1959.
E. Carlton

In a buffing wheel having a hub member, a plurality of fingers radially extending from said hub member, and means for securing the inner ends of said fingers to said hub member, the improvement in said fingers comprising: rectangular pieces of cloth cut on the bias and having at least one of their corners cut off at their inner ends adjacent said hub, said fingers being arranged around said hub so that the edges of said cut-off corner of each finger abuts the edges of the next adjacent finger adjacent said hub, whereby overlapping of any portions of said substantially rectangular fingers is eliminated in any given disk layer.

Multicolor Painting Machine

U. S. Patent 2,915,037. *Dec.* 1, 1959.
R. B. Way and C. D. Hersey

A painting machine for applying paint to an article of manufacture at a plurality of successive stations comprising a plurality of spaced stations, paint applying means on each said station, a conveyor, said conveyor comprising a chain having a plurality of spaced rotatable upwardly extending rods thereon, masks supported on each said station, means to advance said chain intermittently to move one said rod into position under each said mask, an article support on the upper end of each said rod, means on each said station to engage the lower end of each said rod to move said rod upwardly and to bring said article into operative relation to said mask, and means to spray paint through said mask onto said article.

Flexible Abrasive Wheel

U. S. Patent 2,913,857. *Nov.* 24, 1959.
R. W. Reed, W. J. Rankin and B. F. Tungseth, assignors to Minnesota Mining and Mfg. Co.

A rotative abrasive article comprising an annulus of many substantially uniformly positioned radially extending flap sections of abrasive sheet material retained together at the radially inner ends thereof, said annulus having a hub portion and a radially outer abrading portion.

Vapor Phase Corrosion Inhibition

U. S. Patent 2,914,424. *Nov.* 24, 1959.
W. J. Murray, assignor to Arthur D. Little, Inc.

A method for protecting an enclosed metal surface from corrosion which comprises reacting on said metal surface at least two reactants to form a coating of corrosion-inhibiting material in situ on said metal surface, one of said reactants being a basic amine and the other of said reactants being an acidic material selected from the group consisting of weak acids and anhydrides of weak acids, at least one of said reactants being in the vapor state at the time of application and being present in the gaseous medium around said surface in a concentration of at least ten per cent, said amine and said acidic material being brought separately into contact with said surface for said reacting thereon.

Palladium Plating by Chemical Reduction

U. S. Patent 2,915,406. *Dec.* 1, 1959.
R. N. Rhoda and A. M. Madison, assignors to The International Nickel Co., Inc.

A bath for depositing palladium comprising a single-phase, water-containing liquid having in solution about 0.001 to about 0.25 mole per liter of divalent palladium, about 0.002 up to about 0.05 mole per liter of hydrazine, about 0.005 up to about 0.25 mole per liter of a stabilizing agent selected from the group consisting of aliphatic ketones containing from 3 to about 5 carbon atoms per molecule, ammonium salts of mono and di-basic mineral

acids, the disodium salt of ethylenediaminetetraacetic acid and 2,2'-thiodiethanol, about 2.5 up to about 14 moles per liter of at least one substance selected from the group consisting of ammonia and aliphatic organic compounds containing a primary amine group and having up to 5 carbon atoms per molecule and the balance essentially water, said water being in a concentration of at least 2 moles per liter.

Buff Manufacture

U. S. Patent 2,913,319. *Nov.* 24, 1959. *G. R. Trevenna*

A machine for assembling polishing buffs.

Hot Dipping Wire

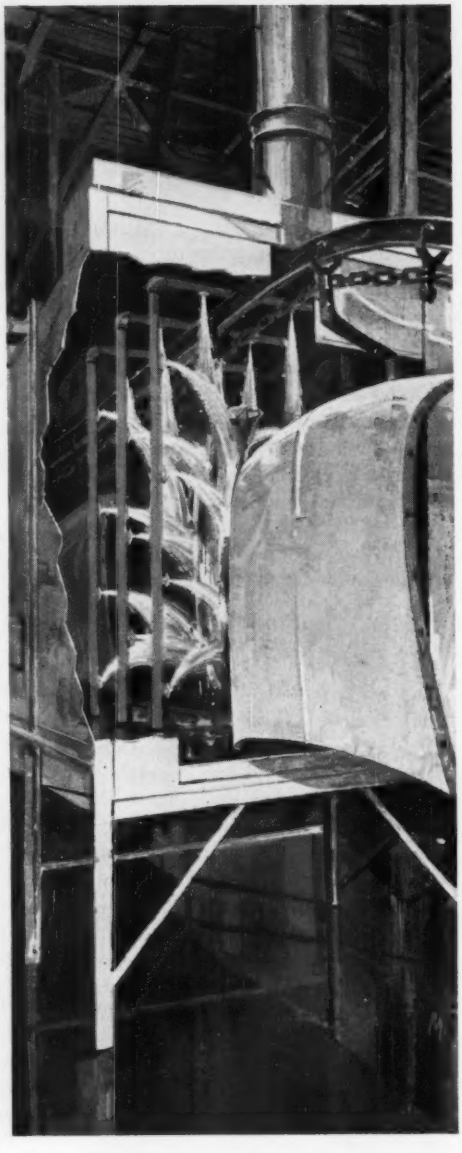
U. S. Patent 2,914,419. *Nov.* 24, 1959. *K. Oganowski, assignor to Armco Steel Corp.*

A process of continuously coating a metal strand-like article with molten coating metal.

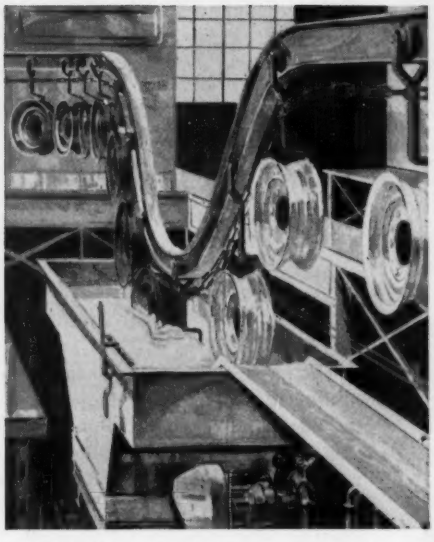
Copper Backing Mirrors

U. S. Patent 2,915,414. *Dec.* 1, 1959. *H. H. Hilemn*

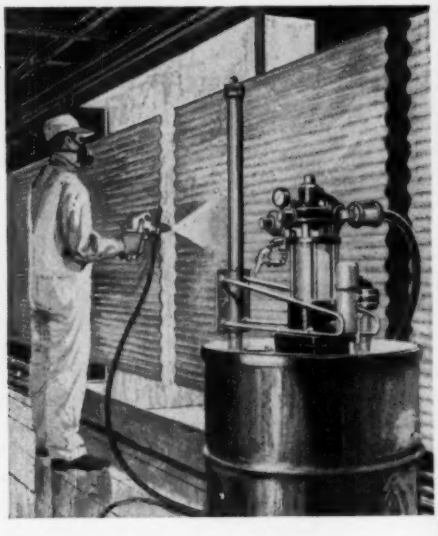
The process of depositing copper on a surface which comprises descaling finely divided iron particles wtih a dilute acid, removing the acid and immersing said particles in sufficient slightly alkaline mixture of glycerin and alcohol to completely cover the particles, adding water to said glycerin alcohol solution to form a suspension of said particles in a dilute aqueous glycerin alcohol solution, applying said suspension to said surface, simultaneously applying to said surface a copper sulfate solution and causing said suspension and said last solution to intermingle for thereby effecting reduction and deposition of copper from said copper sulfate solution on to said surface.



FLOW COATERS give quick, thorough coverage with high paint utilization.



DIP COATERS offer a simple, low-cost way to paint products of varying sizes and shapes.



AIRLESS SPRAY applies heavy paint film to expansive areas with greater speed.

Alkaline Derusting

U. S. Patent 2,915,444. *Dec.* 1, 1959. *W. R. Meyer, assignor to Enthone, Inc.*

The process of removing foreign matter including oxides of iron from ferrous metals which comprises subjecting the metals to electrolysis as the cathode in an alkaline aqueous solution having a pH of above 10.0 and containing an agent selected from the class consisting of alkali gluconate, alkali saccharate, ethylene diamine diacetic acid salts, ethylene diamine triacetic acid salts, ethylene diamine tetraacetic acid salts, hydroxy ethyl ethylene diamine triacetic acid salts, and triethanolamine, said agents having the common property of complexing iron into soluble form, and being present in an amount of from about five grams per liter to saturation.

Hot-Dip Aluminum

U. S. Patent 2,916,397. *Dec.* 8, 1959. *A. Chin, J. E. Woolley and J. D. Warren, assignors to General Electric Co.*

The method of coating with aluminum a metal body having a cleaned surface which comprises applying on the cleaned surface of the metal body a coating consisting essentially of an alkylolamine compound for preserving the cleaned surface, and thereafter applying molten aluminum to the thus treated surface.

Corrosion Prevention — Aluminum

U. S. Patent 2,916,402. *Dec.* 8, 1959. *N. F. Baird and W. J. Monoham, as-*

signors to Westinghouse Electric Corp.

An aluminum object provided with a corrosion resistant coating of high lubricity consisting essentially of a layer of oxidized sperm whale oil and a surfactant, said surfactant consisting essentially of hydrophobic isoctylphenol and hydrophilic ethylene oxide.

Liquid Compound Applicator

U. S. Patent 2,915,859. *Dec.* 8, 1959. *W. C. Burt, assignor to Clair Mfg. Co., Inc.*

In a buffing or polishing machine, a compound spray gun mover for mounting a spray gun relative to the working rolls of said machine.

Gas Plating

U. S. Patent 2,916,400. *Dec.* 8, 1959. *H. J. Homer and O. Cummins, assignors to Union Carbide Corp.*

A method of tin plating material by gas plating which comprises establishing a source of gaseous tin tetraisobutyl, providing a source of dry nitrogen gas, enclosing said material to be tinned, displacing the air from said enclosure by the introduction of said nitrogen, introducing vapors of said tin tetraisobutyl compound into said enclosure and in contact with said material, and heating said material to a temperature to cause thermal decomposition of said tin compound and deposition of tin onto the surface of said material, said gaseous tin compound being admixed with carbon dioxide carrier gas and conducted into said enclosure and in contact with said heated material.

Electroless Nickel

U. S. Patent 2,916,401. *Dec.* 8, 1959. *L. V. Puls and W. R. Vincent, assignors to General Motors Corp.*

A chemical reduction type nickel plating bath comprising an aqueous solution having an initial pH of between 7 and 11 and containing the following in the concentrations indicated:

Nickel ion — From .005 to .20 mole per liter.

Hypophosphite ion — From .01 to .40 mole per liter.

Fluoride ion — From .20 to 1.0 mole per liter.

Alkyl or alkanol amine — Sufficient to provide an N to Ni^{++} ratio of from 1:1 to 10:1.

Carboxylic acid or salt thereof as a buffer.

Sufficient to produce a carboxyl group-to-hypophosphite ion ratio of from 1:1 to 10:1.

Cyanide-Copper Bath

U. S. Patent 2,916,423. *Dec.* 8, 1959. *F. Passal, assignor to Metal and Thermit Corp.*

An improved alkaline-cyanide bath for plating a metal selected from the class consisting of copper and copper base alloys which comprises copper cyanide, free cyanide and a small but effective amount not less than about 0.06 mole per liter of saccharate ion, amount sufficient to improve the anode current efficiency.

Coating Thickness Gage

U. S. Patent 2,916,694. *Dec.* 8, 1959. *E. A. Hanysz and R. L. Saur, assignors to General Motors Corp.*

In measuring means, an oscillator including an electron device having a control electrode and an input circuit connected to the control electrode and an output circuit.

Plating Rack

U. S. Patent 2,916,431. *Dec.* 8, 1959. *S. F. O'Connor, assignor to Western Electric Co., Inc.*

A rack for supporting articles in a plating solution comprising an electrically-conductive member having a plurality of helically grooved apertures therein, a plurality of corrosion resistant helically coiled electrically-conductive elements entering the grooves in said apertures, each said helically coiled element having a tang extending therefrom diametrically across said aperture, and a plurality of electrically-conductive article-holding members having helically grooved portions positioned in said apertures in abutting relationship with the tangs on the helically coiled elements, said helically coiled elements also entering the helical grooves in said portions of the article-holding members for holding said helicallly grooved portions in said apertures.

ABSTRACTS

Chemistry of Drying Oils in Finishes

Peintures, Pigments, Vernis, **35,** 55.

In spite of the very wide range of materials now available to the finish-coating industries, drying oils are still the most economical and widely-used raw materials. To meet competition from the new synthetic polymer materials, a great deal of research has been carried out, both to utilize new varieties of oils in finishes (fish oil fractions, soya, oiticica, turnsole, etc.) and to process these to forms embodying better finish properties.

Modern analytical chemistry has provided the information on which much interesting work is being carried out. Thus, the double bonds of unsaturated oils have been examined and it is now possible to make them undergo a series of reactions, such as the formation of adducts with maleic acid, which now yield maleinized oils soluble in water. Other types of polyols are being used instead of glycerol to produce three-dimensional molecular structures. The possibility of using polyvinyl alcohol as an esterifying alcohol has not been completely successful but special

esters formed by polymerization are being tried out.

New Petroleum Resins in Finishes

P. Delbende: *Peintures, Pigments, Vernis*, **35,** 364.

The resins are prepared by polymerizing with a Friedel-Craft catalyst and are then purified. They resemble rosin in appearance and vary in color from pale yellow to dark brown. These resins are polydienes and are able to react with maleic anhydride to form adducts with new resin properties. The resins are soluble in a wide variety of common solvents.

These polydiene resins are compatible with drying oils, natural and phenolic resins, alkyds, and most other polyolefins. However, vinyl and acrylic resins, and resins containing hydroxyl or carboxyl groups are mostly incompatible. Thus, for example, a useful finish is obtained with 41.5 parts of a petroleum resin-maleic anhydride combination, 54.2 parts linseed oil, 4.3 parts pentaerythritol alcohol and 0.06 parts litharge.

With respect to the field of application for these new petroleum resin finishes, their advantages lie in high stability, solubility in aliphatic solvents and the absence of acid- or alkali-sensitive groups in the polymer chain. They are compatible with melamine and alkyd resins. When baked, the finishes are particularly resistant to blistering, which makes them suitable for metal coating. The maleic anhydride adduct finishes have excellent flexibility and good resistance to soap and alkalies.

These petroleum resin finishes can be produced in the form of emulsions. When used for water-thinned coatings, if necessary with styrene-butadiene, acrylic or other latexes, they have the advantages of good water and moisture resistance, good adhesion, ability to withstand high levels of pigmentation, good soap and alkali resistance, good flexibility. They are particularly useful for obtaining satisfactory finishes on aluminum.

Other field of use include printing inks of varied types, finishes for concrete sealing, impregnation and coating finishes for paper, cardboard etc.

Barrel Plating of Bright Nickel

L. Ades: *Revue du Nickel* (France), **25,** No. 1, 8.

A variety of barrel plating units are now available to satisfy all requirements for bright nickel. Details are given, ranging from the smallest units, arranged to hang from the cathode bar of still plating tanks, up to the largest immersion units, which are handled by a crane.

The following basic bath is used, with appropriate brightener additions.

Nickel chloride	200 g./l.
Nickel sulfate	80-100 g./l.
Boric acid	40 g./l.
Temperature	60°C.
pH	3-3.5
Surface area of load	5-6 sq. m.
Voltage	15-16
Current	500-550 amp.
Deposit	12.5 microns/hour

Dual-Anode Tin-Nickel Alloy Plating from Chloride-Fluoride Baths

K. M. Tjutina and N. T. Kudrjawzew: *Zhurnal prikl. Chim.*, (Russia), **31,** No. 7, 1054.

From three possibilities for obtaining homogeneous tin-nickel plated deposits of constant composition, the authors chose the "Process of Combined Anodes." With this there was used an electrolyte containing: 300 g./l. nickel chloride, 50 g./l. stannous chloride, 30 g./l. sodium fluoride and 35 g./l. ammonium fluoride, operating at a current density of 0.5-5.0 amp./dm.^{2} and 50°C. The current efficiencies were measured both with the two anodes in parallel in the circuit and with them arranged in separate circuits.

In the current density range given above, the ratio of the anode current densities, Sn:Ni, was about 20:1. In order to ensure a cathode deposit of about 65% Sn+35% Ni, the surface area of the nickel anode must be about 20 times that of the tin anode.

Relationship Between Plating Conditions and Growth Form in Copper Plating

H. Seiter and H. Fischer: *Zeitschrift Elektrochemie* (Germany), **63,** No. 2, 249.

The authors investigated the relationship between the growth form and current density. As a standard for the growth form, the transition current density was examined, at which the pyramidal growth form changes over to the cubic growth form. The work showed, apparently, that the same oversaturation always rules at the transition current density.

Under definite conditions, with a pulsating direct current, there is obtained a reproducible spiral growth. From the geometrical dimensions of the spirals, the associated current density can be calculated.

Influence of Mixtures and Additions on the Electrolysis of Sodium Zincate Solutions

By M. D. Sholudiw: *Zhurnal prikl. Chim.* (Russia), **31,** No. 7, 1036.

It was found from measurements of the current efficiencies and the deposition potentials on rotating zinc cathodes in pure solutions of sodium zincate that Cu^{++} and Sb^{+++} ions, being more strongly electropositive than Zn^{++}, exert only an insignificant influence on the cathode process, even at an increased temperature.

A series of surface-reactive organic substances, such as casein, phenols, agar-agar, were found likewise to exert no noticeable influence on the physical characteristics of the zinc deposited from these alkaline baths.

Theory of Bright Baths for Metal Plating

R. Weiner: *Metalloberflaeche*, (Munich, Germany) **13,** No. 9, 269.

From the work conducted, it has clearly emerged that the action of brightening agents in plating baths is of a varying nature. The current density-cathode potential curves of the baths investigated, with the effective brightener additions, in some cases were shifted to positive values and, in others, to negative values by the additions.

Generally, in the practical bright baths in customary use, several additions are employed simultaneously. Very frequently, but in no way overwhelmingly, it was found that even the particularly good brighteners have opposing effects on the cathode potential. With this, it is frequently noted that the potential curves of the finished bright baths do not differ very considerably from those of the basic mat baths from which the bright baths have been developed.

Accordingly, it can be assumed that the brightening action of the brightener addition agents can have at least two different causes. The potential raising action was explained some time ago in a general manner, by blocking of the active places. Apparently very

frequently, although up to now very little attention has been paid to it, a positive shifting is to be discerned in the good bright baths. This is more difficult to explain; one supposition explains it by a partial activation of exposed places at the cathode, by which depolarization can occur.

Another possibility could exist in a change in the hydration condition of the ions being deposited, caused by the additions in the region of the diffusion film formed round the cathode. In most, although not all cases, the assumption of purely absorptive phenomena at the cathode can be dispensed with, as these actions only occur in the presence of considerable current densities. This is in agreement also with the practical phenomena involved in the production of bright coatings.

The widespread assumptions that have been made and broadcast with respect to the action of inhibitors in plating baths, on the basis of the present research and the results obtained, can be regarded for the greater part as incorrect. This is particularly so because the deviations which are observed even with the most carefully carried-out investigations, precisely as with the phenomena encountered under practical plating conditions, clearly show that these occurrences are of a strongly fluctuating nature, and that any rigid significance according to a pre-conceived scheme of operations must be incorrect.

Organic Addition Agents in Metal Plating Baths

R. Glenat: *Chimie et Industrie* (France), **82,** 329.

Certain general rules are given for the effect of addition agents on the plated metal. Deposits contain organic products, and sulfur has been detected in bright nickel coatings. Cyclic deposition can occur, with the additive and plated metal being deposited in alternate layers. In other cases, simple absorption of the metal additive can occur on the plated metal surface. The polarity of the organic additive can be advanced as the reason for its deposition on the cathode.

Broadly, no useful working rules are available for formulating a bright working bath with organic additives. Thus, a brightener active in an acid bath may be useless for an alkaline bath. Similarly, a brightener giving good results in a nickel bath, is of no use for a copper bath. The effect of the addition agent can fall into one of three classes, and the additives can be classified in this manner:

(a) Chelation or complexing of the metal ions in the electrolyte;

(b) Reduction of the surface tension of the electrolyte or the hydrogen overvoltage;

(c) Brightening of the plated coating and auxiliary effects such as leveling.

The chelating agents are useful for controlling and impeding the effect of metal impurities in the plating bath. Thus, 1 g./l. of ethylene diamine tetraacetic acid added to bright nickel baths does not affect the brightness, but any copper or iron present is chelated and cannot be deposited. Similarly, 3 g./l. of this compound can be used to eliminate copper and lead in cadmium baths. The aryl alkyl sulfonates are most widely used as wetting agents. They are used particularly in bright nickel baths. These are anionic additives; cationic agents also used include n-alkyl pyridinium and quinolinium halides (nickel baths) and betaines in alkaline copper baths. Apart from their surface activity, the betaines also have a brightening action.

Better additives have now been developed for leveling action in nickel baths and they fall into two main groups. First are the acetylene alcohols or glycols, such as propargyl alcohol, dimethyl ethynyl carbinol and ethynyl-l-cyclohexanol, which act both as leveling agents and brighteners when added to nickel baths containing sulfonated products. The second group consists of heterocyclic nitrogen compounds and their quaternary ammonium derivatives such as acridine, pyridine, quinoline, and acridinium, pyridinium, and quinolinium salts.

The number of brightening agents proposed for nickel plating baths has expanded very considerably. Here again, the additives fall into two main groups, those containing an SO_2 group (sulfonic acids, amides, imides, sulfones) and those containing a double or triple bond (aldehydes, acetylene alcohols, thioureas, azines, thiazines, etc).

The first group gives a mirror finish only if the surface has been carefully polished before plating. Usually, two additives are used, one from each group, together with a surface-active agent, and even more complex mixtures are now coming into use.

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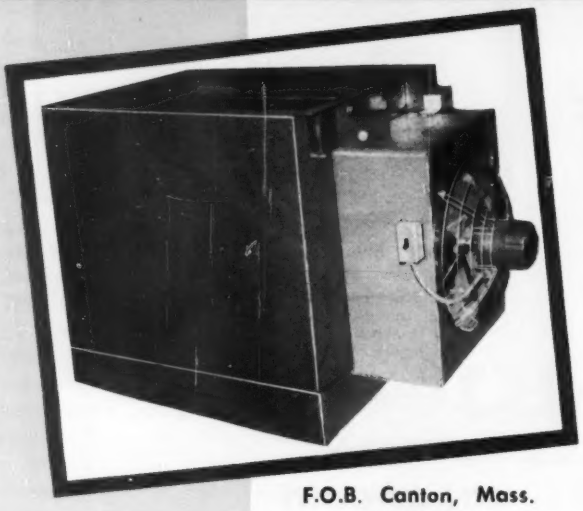

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Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT FOR THE METAL FINISHING INDUSTRIES

Bright Copper Process

Harshaw Chem. Co., Dept. MF, 1945 E. 97th St., Cleveland 6, Ohio.

The Cynorex high speed bright copper cyanide plating process is claimed to eliminate three major copper plating problems:

(1) Operation has been simplified to a minimum through the use of only one addition agent, utilizing the advantages of current interruption — about nine seconds on, two seconds off — to provide optimum conditions for a fine-grained ductile deposit of maximum brightness. The concentration of the addition agent is not critical.

(2) The problem of chromium contamination has been eliminated. The unique bath is not complicated with chelating or complexing agents which hold the chromium contaminant in solution. During electrolysis, the brightener accelerates the reduction of harmful hexavalent chromium to insoluble chromic hydrate, which is then easily and continuously removed by circulating the solution through a filter. During this time, anode and cathode efficiencies remain at 100%.

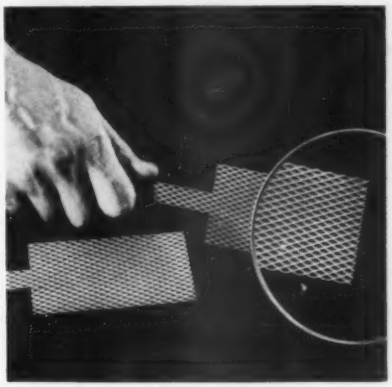
(3) Since the addition agent is nonmetallic and not removed by activated carbon, continuous circulation through carbon without loss of the brightener is possible.

The process will operate with excellent results over a wide temperature range but, in order to minimize cyanide decomposition and carbonate build-up, an operating temperature of about 155°F. will give excellent deposits. It will operate satisfactorily with either cathode rod movement or air agitation. When using air agitation maximum plating speeds can be obtained. The combination of current interruption, proper bath composition and the new brightener, permits improved operation without the use of Rochelle Salt. This reduces make-up and operating costs and permits improved control of contamination by chromates.

Platinum-Coated Titanium Mesh Anodes

Sel-Rex Corp., Dept. MF, Nutley, N. J.

Trade-named Platanium Anodes, this new product is manufactured from titanium-mesh, coated with a uniform thickness of platinum metal, electrolytically bonded by the firm's developed Platanex process. The titanium-mesh is of a diamond configuration design



which, it is stated, affords maximum anode area while cutting down over-all size 50% or more.

Pickle for Aluminum Castings

Conversion Chem. Corp., Dept. MF, Rockville, Conn.

A new non-fuming pickle for aluminum castings, known as Kenvert No. 45, is claimed to produce a much whiter casting than heretofore available, and can treat either machine or sand cast aluminum.

The material is a powder added to 42° nitric acid to form a stable operating solution. When in use the solution does not heat up, nor does it give off brown nitrogen oxide fumes. Long immersion times produce snow white castings, as compared to the conventional nitric - hydrofluoric pickle. Also, work does not fume on transfer.

The product is available in 100 lb., and 400 lb., drums, and can be ordered through distributors throughout the United States. It is manufactured under license in Canada and England.

Protective Resin Coatings

Cosden Paint Co., Dept. MF, Beverly, N. J.

A series of new protective coatings are stated to exhibit high chemical, solvent and abrasion resistance. The coatings are made of polysulfide liquid polymers and epoxy resins, both film formers in their own right. The liquid polymers form flexible, elastomeric films with high resistance to solvents and weathering. The epoxy resins provide hard, chemical-resistant films which adhere tenaciously to many types of materials.

The LP/epoxy coatings are available in several formulations ranging from solvent systems to 100% solids. Even special systems are available for coating wet concrete and wood, damp rusty steel and the like. They may be applied by spray, brush, dip, roller or flow coating and, in some cases, trowel. Most of the coatings cure readily over a broad temperature range to as low as 40°F.

Generator Brush

Hanson-Van Winkle-Munning Co., Dept. MF, Church Street, Matawan, N. J.

The coated Equaload brush is claimed to incorporate five features found in no other generator brush.

1. The brush shunt is made of stranded nickel and provides an exclusive feature.

2. The brush is insulated from the holder by a special silicon-based coating. No current goes through the holder to by-pass the nickel shunt.

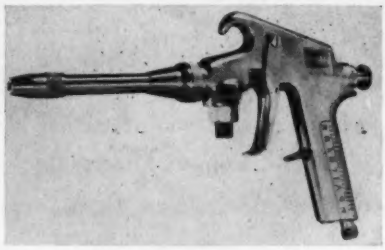
3. Woven glass insulating pad on top of the brush prevents current flow through finger and spring. No current can by-pass the nickel shunt.

4. The brush is made of hammered, flaked copper — not precipitated copper — which provides the lowest coefficient of friction obtainable.

5. The brush is the only brush on the market with a molded-in shunt. It provides a low-resistance connection and eliminates the possibility of pull out.

Spray Cleaning Gun

DeVilbiss Co., Dept. MF, Toledo 1, Ohio.



A high velocity spray, pressure type cleaning gun will deliver a driving spray to knock off dirt and provide coarse, hard-hitting drops to penetrate built-up films. It is adjustable, however, for a full range down to a gentle mist.

The extension nozzle permits spraying into cavities and other hard-to-reach areas and an adjustment on the gun permits a quick change of the amount of material being sprayed. The gun can be used with all common cleaning and degreasing materials. The nozzle and extension tube are of brass and the gun body of aluminum, making it light and easy to handle. Use of an air transformer or pressure regulator is recommended to provide the 6.5 cfm at 60 psi required for the CGA-504 gun.

Soak Cleaner

Mitchell-Bradford Chem. Co., Dept. MF, Wampus Lane, Milford, Conn.

Cleaner #14 has incorporated into its formulation a new approach to emulsification and the latest developments in dispersants, penetrants, wetting and detergency, it is claimed. It is also formulated to accomplish heavy duty soak cleaning.

The material is used 4 to 8 ounces per gallon of water and is to be maintained at 180°F. to boiling, depending upon the type of cleaning to be done. There is also a chemical testing kit available for very quickly chemically testing the concentration.

Bright Cadmium Process

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

The new Cadalume L Process is a modern approach to the demands for a simple-to-operate, low-cost bath for producing bright, uniform, eye-appealing cadmium deposits. The brightener may be added directly to the bath. No

break-in period is required; the desired results with respect to deposit brightness are immediately evident in a balanced bath. The brightener concentration is not critical; there is no decrease in the brightness of deposits with a moderate variation from the norm in brightener content, it is claimed.

The process is characterized by the following:

1. Increased plating speeds.
2. Improved deposit distribution and throwing power.
3. Heavier deposits without loss of brilliance or tendency to form nodules or trees.
4. Stable brighteners with no salting-out effect.
5. No tendency to induce pitted deposits.
6. Wide bright range.

Fluidized Bed Coater

Michigan Chrome & Chem. Co., Dept. MF, 8615 Grinnell Ave., Detroit 13, Mich.

Research and development work on the application of plastic resins by the fluidized bed process is made easy with the new Miccron Research Model Fluidizer. A gallon of resin is more than enough to obtain dip depth in the fluidizer, saves considerable investment in inventory of plastic resin samples used for evaluation.

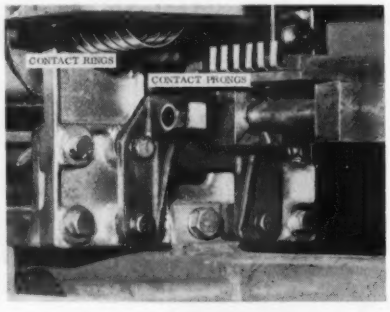
The research device is rugged and simple in construction. A Plexiglass cylinder 5¾" in diameter is divided

into an operating section and a plenum chamber by a special diffusion plate. The over-all height is 10¾", and operating depth is 7¾".

Automatic Selective Processing

Abbey Process Automation, Inc., Dept. MF, 37-01 48th Ave., Long Island City 1, N. Y.

New printed circuit dispatch keys function as carrier guides and controls, utilizing their various printed electrical circuit combinations for directing and activating the movements of the carriers throughout the Abbey-Matic automatic multiprocess cycle system. The key consists of two main components: 1. a small, flat, rectangular base-plate of sheet steel having one edge bent downward at 90° angle to form a lip or "stop"; 2. a printed circuit board of same dimensions with flexible stainless steel contact-prongs at



one end, bent upward at 90° angle. Circuit board is mounted on plate, contact-prongs at opposite end from plate "lip."

Keys are inserted on carriers at loading point; contact-prongs pointed upward. As carriers arrive at stations, key-prongs make contact with matching contact-rings in station receiver units. Course of action at each station is determined and initiated at that point. Thus, key-circuits act as program controls and, once inserted on carriers, they "pilot" their loads unerringly from start to finish. All timing and movements are automatic. Keys can be identified by process name, number, or color.

Ultrasonic Cleaning Unit

Circo Ultrasonic Corp., Dept. MF, 51 Terminal Ave., Clark, N. J.

Model BC-2500 cleaner for large industrial parts is made up of an ultrasonic generator (Model PG2500) and a cleaning tank (Model T2500). The generator was designed for use with automatic or semi-automatic washers and degreasers, manual washers, or for automatic plating. It is 22" wide by 54" high by 18" deep and weighs 350 pounds. Frequency is 36-40KC adjustable; input 6KW, 220 volts; or 440 volts, 60 cycle; 1 phase, continuous high frequency output averaging 3KW; peak output equal to 12KW. Forced air ventilation has been included so that the unit will not overheat. The fluid capacity of the cleaning tank is 75 gallons.

Work Glove Dispenser

Arlington Industries, Dept. MF, 1513 N. Shore Road, Revere 51, Mass.

With the Work Glove Automat, gloves are made readily available to employees yet are always under close administrative check. It is adaptable to any existing glove program — free issue or their sale at cost. The gloves continue to be those purchased from accustomed suppliers.

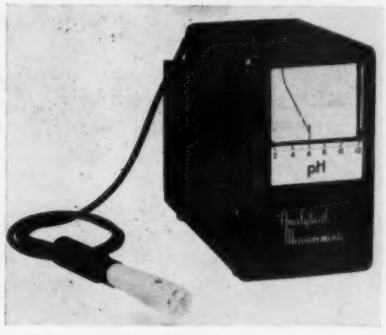
The mechanism consists of a wall-hung steel cabinet operating on special alloy metal tokens to dispense

any type of work glove. Features include a sensitive slug rejector and a non-reset counter. In combination, these function honestly and efficiently, 24 hours a day, as automatic clerk, auditor, and glove depot.

Recording pH Meter

Analytical Measurements, Inc., Dept. MF, 585 Main St., Chatham, N. J.

A combined pH meter and strip chart recorder utilizes an electronically modulated amplifier that compensates for line voltage fluctuations and uses standard radio tubes. A strip chart re-

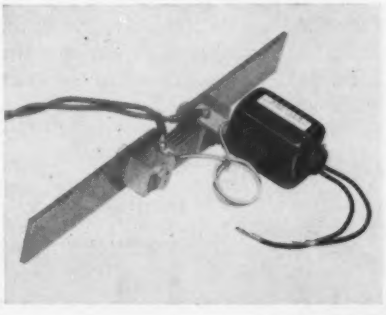


corder forms the front panel of the instrument and contains a 63 ft. roll of chart paper that will last for 31 days at 1 inch per hour. Other chart speeds are available up to 16 inches per hour by a simple gear change. A pressure sensitive coating is used on the chart paper so that annoying ink and clogged pen problems are eliminated. Connections for insertion of a platinum resistance thermometer provide automatic temperature compensation. A switch on the front panel permits disconnection of the chart drive so that the instrument becomes an indicating pH meter. The probe unit provides a unitary glass electrode system completely protected by polyethylene.

Overload Trip

Dresser Electric Co., Dept. MF, 2705 Wight St., Detroit 7, Mich.

"Instatrip," a new overload tripping device for plating or industrial rectifiers, is mounted directly on any size 50 millivolt shunt and interlocked with the magnetic starter or other remote operated disconnect. When D.C. loads reach or exceed a factory preset percentage of the shunt rating, the device instantaneously takes equipment off the line.



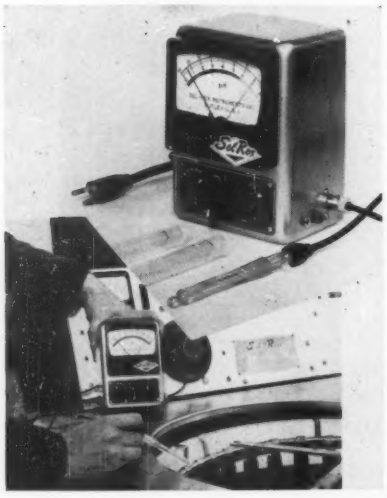
The unit is compact, reliable and easy to install. It is sealed against moisture, dirt, and chemical contamination, and is furnished with factory preset ratings for 80, 90, 100, 110, or 120 per cent of shunt rating.

Portable pH Meter

Sel-Rex Corp., Dept. MF, Nutley, N. J.

Designed by Swiss engineers and manufactured under an exclusive license, the new Electrion line-operated portable pH meter reportedly features a drift-free, constant-reading meter, and a single electrode. Standardization once-a-week or less is said to afford precise, reproducible pH readings.

Other reported design features include: constant-reading meter; amplifier-stabilized, drift-free indicator needle; reference pointer; easily-connected solid ground (usually found only on larger, more expensive units); fast-response tubes which require no

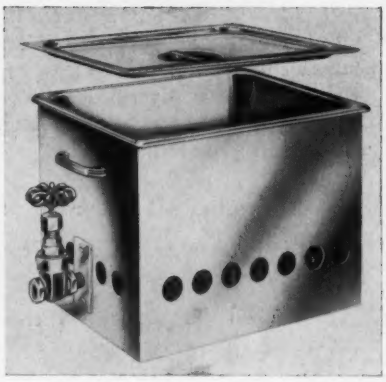


"breaking-in" time spent watching the indicator needle vacillate during readings; 115V line operation to eliminate warm-up time. The meter may be left in continuous service for instant reference and constant pH readings.

Ultrasonic Cleaning Machine

C. & E. Marshall Co., Dept. MF, 1445 W. Jackson Blvd., Chicago 7, Ill.

The generator of this new ultrasonic unit is designed to operate on an input voltage of 110-120 volts, 50-60 cycle a.c., with a nominal power input of 840 watts and an input current of approximately 10 amperes. Average power output of the generator is 285 watts and peak power output is 1130 watts. Cabinets dimensions: Height, 16", Width 22½", Depth 20", Weight, approximately 75 pounds. The generator is supplied with a heavy duty 6 foot power cord suitable for grounded receptacles. All controls handled by operator are at ground potential.



The generator is equipped with a single-pull, double-throw selector switch, so wired that one section switches the output and the other section breaks the alternating current input during the switching operation to prevent arcing and possible switch burn-out due to the presence of extremely high voltage at high frequency in the output section. Cooling is provided by built-in, extra-heavy-duty, high-speed forced-air cooling fan, and an amply ventilated cabinet.

The transducerized tank is made of ventilated heavy gauge, stainless steel and energized by barium titanate ceramics with a frequency of approximately 40 k.c. These ceramics are affixed to the tank by specially compounded epoxy resins under strictly controlled laboratory techniques, thoroughly tested over a period of years to withstand hours of operation at extremely high temperatures.

The inside tank dimensions are: Length, 11¼", Width, 9", Depth, 6". The outside tank dimensions are: Length, 12⅝", Width, 10¼", Depth, 9½". The capacity is 10 quarts.

The tank is equipped with a cord and plug to be plugged into the generator outlet on the front panel of the generator unit. This cord may be detached either at the generator or at the transducer. Use of multiple output jacks enables the operator to change from one tank to another without manually changing tank cords. 32% of bottom area of 10 quart tank is 100% energized. A five gallon transducer tank is also available for this generator.

Sulfuric Acid Feeder

Fischer & Porter Co., Dept. MF, 493 Jacksonville Road, Warminster, Pa.

A semi-automatic wide range feeder continuously feeds, meters, and regulates a flow of sulfuric acid into a liquid stream, and is itself resistant to chemical attack. The feeder, designated as Model 70M2022, has an integral ejector and is equipped with special sulfuric acid resistant diaphragms and O-rings. Its lance-type filtering assembly uses a woven fiberglass filtering element. Metering is by the variable-area method with a direct reading linear scale. The flow rate may be adjusted easily by turning the needle valve on the front of the feeder. Once set, constant flow is maintained, despite variations in supply pressure, by means of a built-in differential pressure regulator. Four models with capacities ranging from 0.4-5 gallons per day to 20-200 gallons per day are available. Maximum operating temperature is 100°F.

Ultrasonic Cleaning System

Branson Ultrasonic Corp., Dept. MF, 40 Brown House Road, Stamford, Conn.

A new ultrasonic cleaning system, claimed to be more efficient for many applications than those using magnetostrictive or barium titanate transducers, is based on a unique, sandwich-type transducer. The new Sonogen Z system is available in both high and medium intensity versions. Standard tank capacities range from 2 to 75 gallons, consuming 150 to 2,000 watts.

The heart of the new system is a lead zirconate titanate transducer, designed to operate at 25 kc. Because it can convert larger amounts of power than barium titanate transducers used with 40 kc installations, it may be operated as a full-wave system, thus doubling the effective power output per unit area. Therefore, higher cleaning efficiencies — up to twice — are possible.

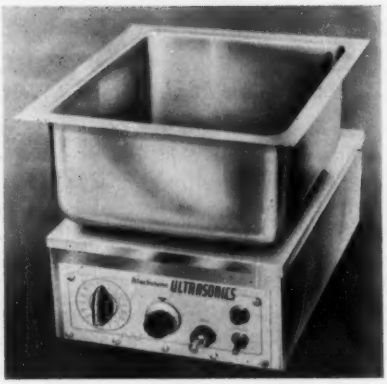
Because of their novel construction, the elements may be completely reclaimed from a transducer housing which has deteriorated due to cavitation erosion. They are simply transferred from the worn housing to another, thus essentially fabricating a new transducer assembly.

Vibratory Finisher

Stevenson Co., Dept. MF, Wellsville, Ohio.

The "Stevadoer" can be utilized as a vibrator for deburring, descaling, cleaning and screening, grading stones, or for surface refinement of any metal parts.

A unique and novel design concept enables maximum tumbling with minimum movement and current consumption. 100% of the media is vibrated in the tub, with negligible vibration transmitted to the base itself, thus requiring no bolting down of the equipment, and it can readily be moved from place to place. The suspension system



and generator as one compact unit. Built-in timer permits selection of desired operating cycle or "hold" position for continuous operation.

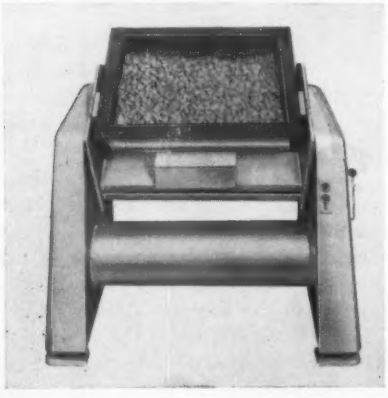
The unit is available from stock with either a one (1) gallon or two (2) gallon capacity tank. Uniform distribution of high intensity sound energy is produced by the new patented magnetostrictive transducer. An operating frequency of 20 KC is used to develop cavitation bubbles of larger physical size that collapse with greater force and work more efficiently. The transducer is air cooled and does not overheat low temperature solutions. Heated solutions to 400°F. may also be used without reduced efficiency or damage to the transducer.

Cold-Applied Emulsion Coatings

Koppers Co., Inc., Dept. MF, Koppers Bldg., Pittsburgh 19, Pa.

Two new cold-applied protective coatings are claimed to be highly resistant to permeation by chemicals. One is a heavy duty protective coating particularly suited for intermittent splash and high chemical "fallout" areas. The new polymer emulsion is called Bituplastic No. 33. The emulsion can be applied by brush, roller or spray. Its extraordinary resistance

permits angular positioning of the tub, while maintaining vibration of the media and parts in any position. In the inverted position it serves to screen the materials. Provisions are made for obtaining various degrees of flow of parts and for varying the amplitude of vibration. Power required to operate the machine is reduced to a minimum and, coupled with the simplicity of design, permits considerable savings in maintenance and operating costs, it is claimed.



Ultrasonic Cleaning Unit

Blackstone Corp., Dept. MF, Jamestown, N. Y.

A new compact ultrasonic system for laboratory applications and precision cleaning requirements, Model SG-2 consists of the ultrasonic tank

to abrasion and high temperature tolerance (up to 400°F.) extends the range of probable use.

The other new coating, Bituplastic No. 44, also has a very low permeability rating. It is ideal as a top coating for insulation.

BUSINESS ITEMS

J. J. Rice New Treasurer for Udylite Corporation

Joseph J. Rice of Grosse Point Woods, Mich., was elected treasurer of the *Udylite Corp.* at the annual meeting of the company. He succeeds *A. L. Barak* who retired.

J. J. Rice

A company employee since 1946, Mr. Rice was previously controller, assistant secretary and assistant treasurer. Mr. Rice joined the firm immediately after five years of wartime service in the U. S. Army Artillery. During his military career, he rose in rank from private to major, and served as a battery commander in the Philippine Islands.

A pre-war graduate of Detroit Business University (B.S., 1938) Mr. Rice continued studies for two years after his discharge at the evening school of the University of Detroit.

Rapid Electric Opens Plant

Rapid Electric Co.'s fourth plant was ready for production scheduling on May 15th. Located in Brookfield, Conn., at the foot of Graysbridge Road, 30,000 square feet of manufacturing and 4,000 square feet administrative and research and development space will be available. This modern plant, when operating at full capacity, will produce both industrial type and plating power rectifiers. Facilities for research and development have been provided for development of regulated power supplies, for magnetics, guided missile systems and nuclear fields. Additional transformer, magnetic amplifier and saturable core reactor winding, laminating and assembly is to be performed in the Brookfield plant.

New Appointments at Sel-Rex

Fred M. Gilbert, sales representative with Diversey Corp. for the past three years, has been assigned by *Sel-Rex Corp.* to their Chicago Office as technical sales representative.

Among the technical and sales positions held by Mr. Gilbert during his nearly 15 years in the metal finishing industry are: 4 years as vice-president, Chromium, Inc., industrial electroplaters; 2 years with Chromium Corp. of America as plating foreman; and process engineer for quality control with General Motors.

Having "grown up" in the electroplating and metal finishing industry—

Fred M. Gilbert

his father was president of a job plating shop for over 20 years—Mr. Gilbert was solving metal finishing problems while still in his teens. This practical experience added to his formal education—he studied chemical engineering at Bowdoin College and mechanical engineering at the University of Connecticut—well qualifies him to provide a "service" over and beyond the sales function to companies in his assigned territory which includes Michigan, Indiana, Ohio, and Kentucky.

Richard L. Brenneman

Long active in A.E.S. activities — he is currently second vice-president— Mr. Gilbert was a charter member of the Kansas City Branch and also served in various other capacities including branch librarian.

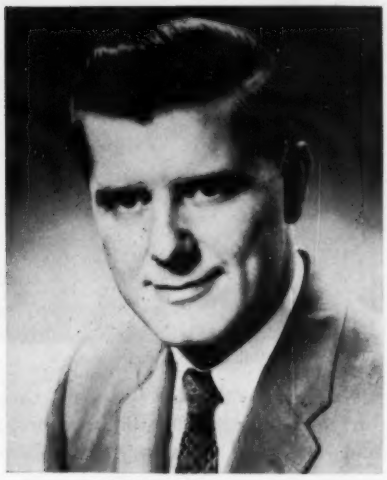
Richard L. Brenneman, formerly chemical engineer with Melpar, Inc., Falls Church, Va., has been appointed to the technical service staff. He will headquarter at the executive offices in Nutley, N. J., and will be given installation and service assignments.

During his more than four years with Melpar, Mr. Brenneman had such assignments as control and analytical work, prototype plating, electronic hardware finishing, experimental work on semiconductor products, and was also group leader in charge of printed circuit pilot plant production, including precious metal processing.

Mr. Brenneman, who studied chemical engineering at the University of Virginia, is currently undergoing an extensive training and indoctrination at the firm's Nutley Laboratories.

The DeVilbiss Co. Appoints Research Director

The appointment of *Clifford Pountney, Jr.*, of Cleveland, as research director for *The DeVilbiss Co.* has been announced recently. Mr. Pountney was director of research for National United States Radiator Co., Cleveland, for three years before taking his new post. He had previously held executive research positions for five years with American Gas Association laboratories in Cleveland.



Clifford Pountney, Jr.

A graduate of John Carroll University in 1949, he completed his master's degree in science in 1950 and for two years was an instructor in physics at the university. He is the author of a number of technical papers, principally on the subjects of heat transfer and fluid flow.

He is a member of the Association of Heating, Refrigeration and Air Conditioning Engineers and of the Cleveland Association of Research Directors.

Duff Appointed Technical Manager of Graver

Graver Water Conditioning Co., New York, division of Union Tank Car Co., has announced the promotion of *Joseph H. Duff* to technical manager. Mr. Duff, who has been with the company for ten years, was formerly assistant technical manager. He succeeds *Marvin Lane*, whose appointment as head of the company was recently announced.

The new technical manager holds a B.S. degree in chemical engineering from the Newark College of Engineering. He has been in the liquid treatment field since 1946 when he completed active service in the armed forces.

Joseph H. Duff

A vice president of the Metropolitan Water and Waste Society, Mr. Duff is also a member of the American Chemical Society and other technical organizations. He is the author of several technical papers and articles on aspects of liquid purification.

Davies Shifts Walraven to Kansas City

B. F. Walraven has been transferred to the Kansas City sales and service staff of *Davies Supply and Mfg. Co.* of St. Louis, according to an announcement. Walraven, formerly assigned to engineering and sales work in the St. Louis area, will cover Oklahoma and

Robert F. Ryan

seven years with Dow he was chosen for their executive training program and appointed product development manager.

Udylite Research Elects Fellows Vice President

Directors of the *Udylite Research Corp.* have announced the election of *Richard A. Fellows* as vice president. He has been general manager since 1958.

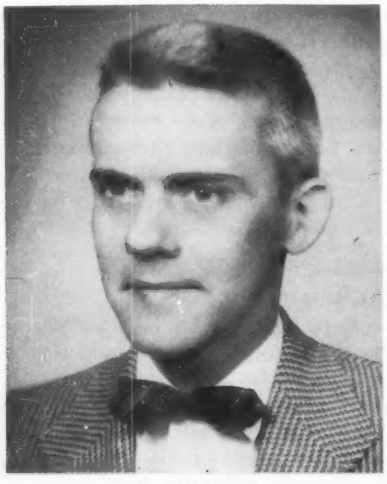
Mr. Fellows joined the Bright Nickel Corp. as a research chemist one year before it became the Udylite Research Corp., a subsidiary of the *Udylite Corp.* Prior to his appointment as general manager, he was a service engineer in the customer service department.

Mr. Fellows, a graduate of Adrian College, is a member of the American Chemical Society, The Electrochemical Society and the American Electroplaters' Society.

Bennett Heads Behr-Manning Field Sales

Behr-Manning Co. of Troy, N. Y., a division of *Norton Co.*, has realigned its coated abrasives sales organization, and has appointed *William J. Bennett* national field sales manager of its coated abrasives division. Regional sales managers for eastern and western regions are, respectively, *Victor F. Perreault* and *Arthur W. Bell.*

Bennett, who makes his home in Albany, N. Y., has been eastern regional sales manager of coated abrasives for the past five years. He has been with the company for 21 years; after selling in both industrial and general trades territories, he became resident product



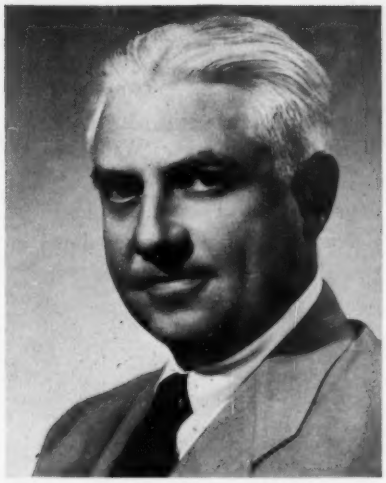
B. F. Walraven

parts of Kansas and Missouri, under the direction of *R. E. Loupee,* Kansas City district manager.

Ryan Midwestern Operating Manager for Kelite

The appointment of *Robert F. Ryan* as Midwestern Operating Division manager has been announced by *Kelite Corp.* He will manage regional sales and will co-ordinate the Technical and Internal Control Departments at the firm's Chicago facility, where he will be senior executive.

Upon receiving his M.S. in organic chemistry from North Dakota Agricultural College, he joined The Dow Chemical Co.'s technical service and development department. During his



William J. Bennett

engineer at Cleveland in 1944, responsible for developing the flat sheet polishing program.

In 1947 he became sales manager of the Detroit division and in 1950 was transferred to the main offices at Troy. Since then he has served as manager of product engineering and of industrial trades sales.

Houghton Opens New West Coast Plant

To handle its increasing West Coast business, *E. F. Houghton & Co.* has opened a new plant at 54 Tanforan Ave., South San Francisco. Industrial oils and chemicals formerly manufactured at the plant at 1500 Davidson Ave., San Francisco, are now being supplied from the new facility.

Equipment newly installed includes provision for sulphonation, saponification, compounding, esterification and condensation reactions. Capacity has been increased more than 50% over the former plant.

The new plant is located on a three-acre plot and includes 30,000 sq. feet of manufacturing space, a new office building, control laboratory and 10,000 sq. ft. of outdoor storage area.

Michigan Chrome Promotes Collins

The election of *William T. Collins* as assistant secretary has been announced by *Michigan Chrome and Chem. Co.*

Collins served overseas with the Army from 1943-1946 in Hawaii, the Phillipines, and Okinawa. He was graduated from the University of Michigan in 1950 with a degree in economics, and has been employed by the company since 1950 in the accounting department.

General Electric Appoints Harden and Hamlin

R. L. Harden has been appointed sales representative for the Eastern district of the Silicone Products Department, *General Electric Co.*, with offices at 1405 Locust St., Philadelphia, Pa. He replaces *L. J. Sacks*, who was recently appointed to fill the position of Western district sales manager.

Mr. Harden joined the department in July 1955 and, since November of that year, has served as materials engineer in the Eastern district. He has held previous positions as manager of the Farm Equipment Division of the Gate City Steel Co.; manager of the Washington, D. C. sales area of Gus-

R. L. Harden

James E. Hamlin

tin-Bacon Mfg. Co.; and was also a salesman for the Shell Oil Co.

James E. Hamlin has been appointed sales representative for the East Central district. His office location is 1503 Brookpark Road, Cleveland, Ohio.

Mr. Hamlin is a 1954 graduate of the University of Notre Dame with a Bachelor of Science degree in mechanical engineering and a 1958 graduate of Cornell University, where he obtained a Master's Degree in business administration. He joined the company in 1954 as a test engineer in the Large Steam Turbine-Generator Department, Schenectady, N. Y.

In 1956, he transferred to the company's Light Military Electronics Department as a product design engineer where he served until 1958 when he joined the firm's marketing training program. Since October of last year he has served as a salesman in training at the Silicone Products Department's headquarters in Waterford.

Carollo Appointed by Rinshed-Mason

Ben Carollo has been appointed in-

Ben Carollo

dustrial and automotive sales representative in the state of Indiana for *Rinshed-Mason Co.*, Detroit manufacturer of industrial finishes and chemical coatings.

Conversion Chemical Licenses British Firm

Conversion Chemical Corp. announces licensing of *Silvercrown Ltd.*, London, Eng., for the manufacture of the complete line of Kenvert specialty items in England, the British Commonwealth (excluding Canada), and the outer seven of the European common market.

Barrett Appoints New Sales Representatives

Four new sales representatives to serve areas in the Midwest and West Coast have been appointed by *The Leon J. Barrett Co.* of Worcester, Mass. manufacturers of centrifugal equipment. Representing the firm in the Detroit area will be *Lor-Mac Associates;* in the Cleveland area will be *The Aldrich Co.;* serving the San Francisco area will be *W. A. Borden Co.;* and serving the Los Angeles area will be *Stearns Sales Co.*

Williamsville Buff Moves to Utica

Williamsville Buff Company, Inc., newly established in Utica, N. Y., has

started operation recently on the premises of *Divine Bros. Co.* at 200 Seward Ave. The machinery and equipment of the Connecticut plant have been moved to Utica where it is in operation, and the business is continuing as usual at the new location, serving its many valued customers as heretofore.

John H. Nelson

Williamsville buffs were formerly manufactured by the Williamsville Buff Division of Bullard Clark Co., a 67-year old polishing and buffing manufacturer in Danielson, Conn. The buffing and polishing wheel products will be manufactured under the same brand and of the same quality. The company will operate under the sales management of *John H. Nelson*, who has been with the organization for 14 years.

International Nickel Holds Annual Organization Meeting

Richard A. Cabell, Albert P. Gagnebin, Ralph H. Waddington and *James C. Parlee* were elected vice-presidents of *The International Nickel Co. of Canada, Ltd.*, at the annual organization meeting of the board of directors.

At the same time, *John A. Marsh*, vice-president of the company's United States subsidiary, *The International Nickel Co., Inc.*, was elected to the further office of president of its Huntington Alloy Products Division at a subsequent meeting of that company's board of directors. Mr. Marsh was also elected a director of that company.

It was also announced that *Paul Queneau* had been elected technical assistant to the president of the Canadian firm.

Stratford Chemical in New Location

Stratford Chemical Co., Inc., is now located in Derby, Conn. At the new address, increased floor space will allow for expanded research, customer service, and production facilities.

The plant is located on the east side of Roosevelt Drive, Route #34, four tenths of a mile above the center of Derby.

Body Bros., Inc. Appoints Began

Appointment of *Robert A. Began* as technical service representative has been announced by *Body Bros., Inc.*, Bedford, Ohio.

Mr. Began's entire business career has been in the industrial paint manu-

Robert A. Began

facturing field. He was employed previously for several years with another paint manufacturer. From 1955 until his recent promotion he was plant superintendent. His industrial paint experience includes several years of development work in the laboratory.

Mr. Began attended Case Institute of Technology and John Carroll University in Cleveland.

Planet Plating in New Quarters

Planet Plating Co., Inc., formerly located at Morgan Ave., has moved to new and most modern quarters at 1333 Flushing Ave., Brooklyn, N. Y., utilizing more than 15,000 sq. ft., which will include executive offices as well as plant space.

Strategically located near major highway arteries and trucking terminals, the newly relocated and equipped plant will be the world's largest installation devoted exclusively to barrel electroplating of plastics, it is stated.

Friedt Elected V.P. of United Platers, Inc.

Theodore K. Friedt has been elected vice-president and assistant general manager of *United Platers, Inc.*

Friedt, who is 32, started with the company in 1948 as a maintenance man. He served as production foreman, superintendent, and plant manager before being named to his new post. He was graduated from Florida Military Academy and attended the University of Miami and Kalamazoo College.

Theodore K. Friedt

MacDermid to Build New Laboratory

Construction will begin immediately on a new research and development laboratory for *MacDermid Inc.*, Waterbury, Conn. manufacturer of metal cleaning, plating and finishing chemicals. The new two-story addition to the existing research and manufacturing facilities will have about 7,000 square feet of floor space.

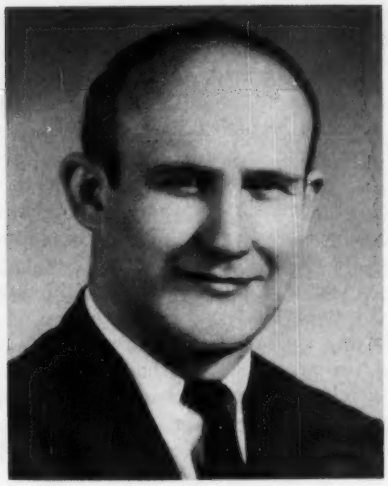
Ramm Electric in New Location

Ramm Electric Co., Inc. announces that its new facilities are now located at 527 Faile St., Bronx, N. Y. The firm designs and manufactures regulated and unregulated D.C. power supplies in all ranges, and its engineering department is equipped to convert existing rectifiers, do field service, assist in mechanical and electrical design problems.

The staff was organized by *Ted Mendel*, former chief electrical engineer for a leading rectifier manufacturer. He was joined by *S. Reebman*, M.E., P.E., with fourteen years experience in electromechanical design.

Decorative Engineering Names Product Service Manager

Decorative Engineering and Supply, Inc., Gardena, Cal., manufacturer of spray masks, and automatic spraying



Albert L. Mulinix

equipment, has named *Albert L. Mulinix* as product service manager. He joins the company after 13 years' experience in similar work with Eastern firms.

Wolff New Vice President of Van Straaten

Robert E. Wolff has been elected vice president, marketing, of the *Van Straaten Chem. Co.*, Chicago. He joined the makers of metal working compounds last year as general sales manager. He had been sales manager of the Tool and Instrument Division of Illinois Tool Works.

Mr. Wolff graduated in industrial engineering at Northwestern University with a B.S. degree in 1937. He joined Link Belt Co., Chicago, as a sales trainee. He next went to Illinois Tool Works in 1940 as a trainee and assistant to the sales manager. He spent 19 years at Illinois Tool, heading all phases of the marketing program. During this time he served as a specialist at the NPA in Washington on jet engine production.

Mr. Wolff is a member of the American Society of Mechanical Engineers, American Society of Tool and Manufacturing Engineers, a member of the Economic Club of Chicago, the Tavern Club and the Knollwood Club.

New Representative for Atlas Mineral

Bernard Rodsky, with offices in the First National Building, El Paso, Texas, has recently been appointed to represent *Atlas Mineral Products Co.* in the Western Texas territory.

New Plant for DuPont

DuPont has announced the opening of a new paint plant, in Malines, Belgium, operated by a subsidiary company, *DuPont de Nemours (Belgium) S. A.*

The plant, which employs about 100 persons, produces automotive, household, and industrial paints, and is the first producing facility to be put in operation by the firm's subsidiary companies in Europe. The Belgian Minister of Economic Affairs, *Jacques van der Schueren;* the United States Ambassador to the European Economic Community, *W. Walton Butterworth;* and the Mayor of Malines, *Antoine Spinoy*, participated in the ceremonies.

Coleman Co. Presents Gift to University Library

Back issues of METAL FINISHING are a part of a collection of more than 200 books and periodicals presented recently by the *Coleman Company, Inc.*, to the University of Wichita library.

The books and periodicals were collected from departmental and personal libraries within the manufacturing and engineering division of the company, a manufacturer of heating and air conditioning equipment, gas lanterns and outing products.

Inspecting the collection prior to cataloging are *Downing P. O'Harra*, left, University librarian, and *E. G.* man Training Institute.

O'Harra termed the donation "an

appropriate and timely reminder of industry's growing interest in our educational facilities."

Onyx Forms New Corporation

Onyx Oil & Chem. Co., Jersey City, N. J., was recently merged with the *Onyx Chem. Corp.*, a leading producer of detergents and other related raw materials for the metal finishing trade.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Another Candidate for 3rd Vice-President

E. E. Oberland

The *Baltimore - Washington Branch* has presented *E. E. Oberland*, its current president, as a candidate for the office of third vice-president of the American Electroplaters' Society. Ed is a chemical engineering graduate of the University of Wisconsin, and has been associated with the Western Electric Company for many years, in Chicago, New York and Baltimore.

He has had a variety of assignments, including supervisory, in the industrial engineering field, and participated actively in the Industrial Management Society, becoming its executive secretary while in Chicago. His present activity, covering eight years in this field, is senior development engineer responsible for planning and development in electroplating, metal cleaning, and organic finishing at the Baltimore Plant of Western Electric. As well as being active in civic affairs in an executive capacity, he has served diligently in the Baltimore-Washington Branch, having been librarian, secretary, vice president, and president, and as a delegate to national conventions.

Newark Branch

President *John Banta* called the April 22 meeting to order at 9:00 p.m. The late starting time was due to long supper hour, since the largest group (about 45 members and their wives) attended the Dutch Treat Dinner, and the restaurant facilities were severely overtaxed.

In view of the late start, and as it was Ladies Night with a large program ahead, a motion was made and passed, that no regular business be conducted except for the processing of new members. Hence, two applications were received, and *Modesta Retemari* was elected.

The meeting was then turned over to *Al Korbelak* who introduced Mr. De Lorenzo, the Eastern representative of Almaden Vineyards, who showed two very interesting films on "Wine Making" and "The Use of Wines in Cooking." *Cy La Manna*, the new librarian, then presented *Miss Elissa Rinker* who performed a pantomine and dance skit. It was quite enjoyable and the audience gave her a big hand.

Following this, Mr. La Manna called upon *Mr. and Mrs. William Grigat* to conduct the game of Bunco. Details of the game were explained and a trial run was made. The game provided entertainment, as the winning couples moved up a table, it gave all a chance to meet new people. The game was ended after about one and one half hours of play, and John Banta and Mrs. Grigat presented prizes to the winning ladies. Gentlemen were not permitted to win. Refreshments were then served.

Gustav Bittrich,
Reporting Secretary

St. Louis Branch

There were 24 members and guests for dinner at the regular monthly dinner meeting, held at the York hotel April 13. The business meeting was called to order by President *William Piel*, with 36 members and guests present. After the reading of the minutes and the treasurer's report, five new members were accepted into the organization. Old business consisted of reports from the School Committee.

Andy Julius reported on his attendance of the Interim Meeting in Philadelphia and the meeting of the Midwest Regional held in Chicago in January. It was decided there to have St. Louis host the exposition and the convention in 1964. The Hotel Jefferson would be headquarters, with the Keil Auditorium Exposition Hall handling the exhibits.

New business consisted of the report of the nominating committee which was headed by *Craig McAlister* with *A. P. Wrisberg* and *Robert Coulson*. Their slate was as follows: President, *George Koderhandt;* 1st V. P., *Homer Thomen;* 2nd V. P., *Peter Young;* Secretary, *Ward Kelly;* Treasurer, *Louis Berra;* Librarian, *G. Kenneth Robins;* Sgt.-at-Arms, *Donald Koehler;* Board of Managers: *William Piel, Andy Julius, L. A. Davies.*

The secretary was instructed to cast a unanimous ballot for the slate. The delegates elected for the period following the 1960 convention through 1961 convention are: *William Piel, Andy Julius,* and *Robert Coulson.*

Gerard Clooney was appointed research finance chairman, and, there being no further business, the meeting was turned over to Librarian *Richard Gotsch*, who introduced the speaker of the evening, *Frank M. Macioce*, of Industrial Filter & Pump Mfg. Co. Chicago, Ill. His subject was Pollution Abatement as Related to the Electroplating Industry, and was illustrated by blackboard diagrams and formulae. An active question and answer period indicated the interest of the group, and the meeting was adjourned with a rising vote of thanks.

Ward Kelly
Secretary

Waterbury Branch

The Branch held its meeting at the Roger Smith Hotel on April 14. Final arrangements were made for those who planned to attend the 21st Annual New England Regional Meeting. Approximately 150 people are planning to attend from Waterbury.

Thomas F. Rush was awarded a certificate of membership at this meeting. The annual election of officers was held and the following officers were elected:

William Giesker — President
Louis Porretti — 1st Vice-President
Albert Griffith — 2nd Vice-President
James Kennedy — Secretary
Patrick Mazzamaro — Librarian

Delegates: *Frank Tirendi, William Giesker, Martin Sternfel*

Alternate Delegates: *Clarence Foster, Ralph Colter, Michael Orient*

Technical Chairman *Lewis Doughty* introduced the speaker for the evening. He was *Dr. M. M. Beckwith* of The Harshaw Chem. Co., who spoke on duplex nickel plating. Dr. Beckwith presented an excellent paper, supported with numerous slides showing results of accelerated and exposure tests which demonstrated the effectiveness of duplex nickel plating in inhibiting corrosion failure of nickel-chrome plating.

Francis A. Schneiders,
Publicity

Phoenix Branch

Twenty-one members and guests enjoyed the first meeting at the new meeting place, The Outpost, 3400 N. 60th St., Tuesday, April 12. In the absence of President *Bill Griff*, First Vice President *Floyd Huhn* opened the meeting at 8:00 p.m. after one of the best dinners this year.

Secretary *James Weaver* reported on the proposed representation in the Arizona Council of Engineering and Scientific Societies. Treasurer *John Mullarkey* reported on the successful Symposium held at A. S. U. in March. The secretary was instructed to write thank-you letters to the contributors to the success of the symposium.

Mr. Huhn also called for appreciative notice for *Paul Wible*, chairman of the symposium and members of his committee. *John Mullarkey* spoke briefly on future plans for a swim party to be held in June. It was voted to have members, wives, and friends only, and not children at this affair. Librarian Wible introduced the speaker, *S. R. MacIntosh* of Tin Research Institute, who discussed tin and tin alloy plating. Many questions on this subject, and some in the realm of

Calendar of Association Meetings

June 26-July 1: 63rd Annual Meeting, A.S.T.M., Chalfonte-Haddon Hall Hotel, Atlantic City, N. J.

July 22-24: 5th Anniversary Convention, N.A.M.F., Statler-Hilton Hotel, Los Angeles, Calif.

July 24-28: 47th Annual Convention, A.E.S., Statler-Hilton Hotel, Los Angeles, Calif.

Sept. 16: 2nd Metropolitan Regional Technical Session, Newark Branch A.E.S. Host, Robert Treat Hotel, Newark, N. J.

Sept. 17: 24th Annual Educational Meeting and Banquet, A.E.S., Hotel Statler, Boston, Mass.

Oct. 9-13: Fall Meeting, The Electrochemical Society, Shamrock Hotel, Houston, Texas.

Oct. 17-21: 42nd National Metal Exposition and Congress, A.S.M., Trade and Convention Center, Philadelphia, Pa.

Oct. 27-29: 73rd Annual Meeting, National Paint, Varnish and Lacquer Association, Drake Hotel, Chicago, Ill.

Oct. 29: 2nd Annual Midwest Regional Conference, University of Notre Dame, So. Bend, Ind.

Oct. 31-Nov. 2: 38th Annual Meeting, Federation of Societies for Paint Technology, Hotel Sherman, Chicago, Ill.

Nov. 8-11: First National Exposition and Congress, Society of Die Cast Engineers, Detroit Artillery Armory, Detroit, Mich.

Jan. 17-18: Annual Meeting and Conference, Society of Vacuum Coaters, Lake Towers Motel, Chicago, Ill.

soldering, showed the appreciation of the fine presentation by Mr. MacIntosh.

Two new members were approved: *William Bath* of General Electric, and *Michael J. Sullivan.*

James E. Weaver
Secretary

British Columbia Branch

A general meeting was held on Wednesday, April 13, at the Lougheed Hotel, N. Burnaby. Following cocktails and dinner, the meeting opened at 8:30 p.m., with President *Nelson Shepherd* in the chair, who welcomed guests and members.

An application for admission to the Branch was received from *S. T. Abbot,* and read to the meeting. It was regularly moved, seconded, and carried unanimously, that Mr. Abbot be admitted and that his dues should start as from the 1st June, 1960.

Gordon Smith was elected president for the coming year. Others elected were: 1st Vice President, *W. Kilby;* 2nd Vice President, *H. Schenke;* Secretary, *C. Schlossareck;* Treasurer, J. *Hurford;* Program Director, *W. Marquardt;* Directors, *V. Huene* and *G. Caslor;* Bartender, *J. Lee,* assisted by *R. Wolloschuk.*

Discussion then took place concerning the state of the Branch funds, and the two meetings yet to take place before the close of the year. It was felt important that a good turn out should be looked for when *John P. Nichols* visits the Branch. It was decided that the meal for the May 3rd meeting be reduced to $1.00 per head, and that donations of $5.00 be received from plating shops, who were willing to make such donation.

St. Joseph Valley Branch

The second annual Midwest Regional Conference will be held October 29, 1960 at the University of Notre Dame, South Bend, Ind.

The Engineering Auditorium at the University has been reserved for the full day, and an additional lecture room for the afternoon workshop sessions. Luncheon will be held in the Mahogany Room of the famous Morris Inn.

Local committee chairmen are: *Dr. Ernest Wilhelm,* facilities; *John Bayman,* luncheon; *Sam Alfano,* hospitality; *Ralph Brouwer,* publicity; *Henry Meers,* luncheon speaker; *Louis Ragues,* exhibits; *Si Gary* of Chicago branch, chairman, librarians of all branches, educational sessions.

Los Angeles Branch

New officers for the 1960-61 term were installed at the April 13 meeting of the Branch in Rodger Young Auditorium, in the presence of 85 members and guests. Past President *Ed Wells* served as installation officer, presenting the gavel of authority to incoming president *Frank Virgil,* and inducting the other officials chosen in March to serve the branch during the next fiscal year. Wells also presented a past-president's pin to retiring president *George Hetz,* and a plaque bearing the inscription: Presented by the American Electroplaters' Society, Los Angeles Branch, to George Hetz in appreciation of honorable service as president in 1959-60.

Wells recapitulated the progress the branch had made during Hetz' administration and lauded the outgoing president for the burden of work he had

carried during the past year as president, as well as co-chairman, of the national convention committee.

Incoming second vice president *Harvey K. Hunt* suggested that the branch's dormant exhibits committee be re-activated because, in his opinion, exhibits of plating products had been a popular adjunct of annual educational sessions in years past.

The new librarian, *Don E. Baudrand,* made a commendable proposal for improving the quality of monthly educational programs and assuring increased attendance. Don announced that he had two actions in mind:

1. That the monthly meeting announcements carry information about the speaker and his subject for that month's meeting, as well as for the month to follow. That advance notice, Baudrand said, would give members more time to arrange to be present at a meeting at which a talk on a subject of particular interest to them was to be presented.

2. He proposed to poll the entire membership for suggestions on the type of technical papers and/or panel discussion they preferred. Special efforts would be made, Baudrand promised, to obtain authoritative speakers on subjects the majority of members demand. As far as possible, Don also announced, he would attempt to draw up the educational program several months in advance.

Baudrand and President Virgil were to confer shortly on the choice of two appointed members to serve as assistants to the librarian. The decision will be announced at the May 11 meeting. The members approved an amendment to the by-laws in March providing for appointment by the president of two members to collaborate with the elected librarian in planning educational programs.

President Virgil announced that *Oscar Grizzett* has been appointed as the new sergeant-at-arms. *George Hetz,* co-chairman, reporting for General Convention Chairman *Tony Stabile,* announced that the technical program for the 1960 A.E.S. convention was set, and that the general committee and sub-committees now were busy arranging for the extra-curricular activities of the entertainment program, the ladies program, etc. Hetz' enthusiasm was infectious as he predicted that the Los Angeles National Convention in July will undoubtedly be a memorable one in A.E.S. annals.

Guests introduced included *M. C. Moroney* and *Paul Sutrio* of the Saltex Co., *G. W. Hartman* of Wyandotte Chem. Co., *Gene Sullivan* of Crown Chemical & Engineering Co., who is transferring from New Haven, Conn. branch, to Los Angeles branch; *Frans L. Hencke,* formerly of Apeldoorn, Holland, now a Sel-Rex Corp. sales engineer in Los Angeles; and *H. R. Smith,* Packard Bell Electronics Co. *Carmel DeLucca* of Space Age Plating Co., was inducted into membership.

Chicago Branch

On Friday, April 8, members of the Branch made their first plant trip, a visit to the Sunbeam Corp. The members met at Plant No. 3, and were escorted in groups of twelve through the plants by a guide. The following operations were visited in the plants: (1) a strip polishing line (2) buffing and coloring of fry-pans (3) percolator polishing and buffing (4) toaster shell buffing (5) clipper shaver comb buffer

(6) automatic chrome plating (7) automatic copper plating (8) barrel nickel plating (9) automatic nickel plating (10) combination of nickel and automatic chrome plating. The tour was highly educational and very interesting in showing the finishing operations on the various products made at Sunbeam. *Barney Case*, finishing superintendent, who planned the tour, conducted a question and answer period regarding the various operations after the refreshment period.

The members then met at Petricca's Restaurant, 3237 North Harlem Ave. for dinner and business meeting. *Ed Stanek* gave a report that the "Annual Ladies-Nite" will be held at the Austin Fine Arts Club, 5650 W. Chicago Ave., on Saturday, May 7th, starting at 6:30 P.M. Nine members were accepted and approved by the board of managers. *Paul Glab* urged that members promptly pay their dues and, if not paid, members will be notified in July of their suspension. *Father Roll*, a member of the Chicago Technical Societies Council, was a guest and spoke on the functions of the Society Council.

Scott Modjeska installed the officers for the coming year: President, *Matt Dassigner;* 1st Vice-President, *Rudy Hazucha;* 2nd Vice-President, *Joseph C. Corre;* Secretary, *Paul Glab;* and, Librarian, *Simon P. Gary*. The board of managers are *Charles Geldzahler*, chairman; *Richard Connors, Edward Stanek, Bob Waits*, and *Christopher Marzano*. The board of managers were asked to settle on a meeting place for the coming season at the July meeting. The next technical meeting will be held at Petricca's on Western and Grand Avenue on Friday, June 10.

Christopher Marzano,
Publicity Chairman

Rochester Branch

The April 4th meeting of the Branch was called to order by President *Anthony Cottrone* at the Rochester German Club, who introduced to the members two distinguished guests. *Harold Harper* of the Austin Fletcher Co. and *Morgan Rake* of International Business Machine Co. Mr. Rake extended a personal invitation on behalf of the Southern Tier Branch to those present to attend the 6th Empire State Regional Meeting to be held in Elmira April 29 and 30.

Second Vice-President *John Cipolla* reported for the Christmas Party Committee on possible reservations and it was voted to accept as first choice the Redman's Club and as second choice the Midvale Country Club.

The following slate of officers for 1960-1961 was presented by Past President *Frank Beuckman*, chairman of the nominating committee, for consideration by the Branch:

President — *Anthony J. Cottrone.*
1st Vice-Pres. — *John Cipolla.*
2nd Vice-Pres. — *William Elston.*
Librarian — *Loring F. Carson.*
Treasurer — *Emil A. Pottridge.*
Secretary — *Barrie M. Gardner.*
Board of Managers — *Robert Flint, Don Blum, Fred Johnson, Vern Schaefer, Fred Thiem*, and *Frank Beuckman.*

Hospitality Chairman — *Victor Bonaldi.*

Benevolent Committee — *Fred Thiem, Jack Pandina*, and *Sam Guinta.*

Upon a motion of *Vic Bonaldi* it was decided to present to the president and to all past presidents of the branch a pin as a token of the Branch's appreciation of their service.

President Cottrone announced the appointment of *Vern Schaeffer*, chairman, and *Victor Bonaldi*, co-chairman, of a committee to handle the arrangements of the Branch's Golden Jubilee to be held in 1961.

Librarian *Frank McNutt* introduced *Arthur Kohler* of the Frederick Gumm Chem. Co., who gave a very interesting and informative talk on "Tumbling". Following Mr. Kohler's talk, refreshments were served through the courtesy of *Charles Clark*, area representative of the company.

Barrie M. Gardner,
Secretary

British Columbia Branch

A general meeting was held at the Lougheed Hotel, Lougheed Highway, North Burnaby, B.C. on Wednesday March 30th. Following cocktails and dinner, the meeting opened at 8:45 p.m. with President *Nelson Shepherd* in the chair, who welcomed guests and members to the meeting.

The president presented certificates to all successful students of the night school course. Congratulations were extended to them by the instructor, *W. Kellerman*, who thanked A.B.C. Plating and Coast Testing Labs. for their help in making the course a success.

A report by Mr. Kellerman, chairman of the committee set up to go into the costs of night school equipment, was given. Mr. Kellerman advised that a list of items had been prepared and handed to the authorities.

A report was given by *G. Smith* regarding the night school course, in which he told the meeting that he had copies of the course, examination paper, and reports, available for the membership to see. The president advised the meeting that he had received a letter from *John P. Nichols* regarding the executive secretary's visit to Vancouver and that, therefore, the next meetings had been arranged at the Lougheed Hotel, for April 13th and May 3rd, the latter date being to fit in with Mr. Nichols' visit.

The president then presented the following nominations for the election, which will take place at the April meeting.

President — *G. Smith, N. McLeod.*

1st V. President — *W. Kilby, J. Stoneberg.*

2nd V. President — *Jim Hurford, H. Schekne.*

Secretary — *R. Wolloschuk, C. Schlossareck.*

Treasurer — *G. Caslor.*

Program Chairman — *W. Marquardt, G. Ensinger.*

Directors — *V. Huene, A. Vriends, I. Peacock, H. Roberts.*

N. Shepherd then introduced the speaker, Mr. Hamper of the B.C. Safety Council, who outlined the organization of the Council, and spoke on safety in the home, industry, schools recreation, traffic, etc. and discussed compensation assessments which vary from industry to industry depending on the rate of frequency of accidents.

This was a very interesting and informative talk, and *G. Smith* moved a vote of thanks to Mr. Hamper, which was unanimously given. The meeting closed at 10:30 p.m.

D. Armstrong,
Secry.

Columbus Branch

On April 1, 35 members of the Branch were entertained by a plant tour and dinner. The program was arranged by *Marvin Pingel* with the compliments of the Appliance Division of Westinghouse Electric Corp. The tour offered a close view of the entire assembly process for refrigerating units.

Annual Branch elections for 1960-61 officers were held at a short business meeting prior to the tour.

Leslie D. McGraw

Buffalo Branch

The Branch held its meeting Friday, April 1, 1960, at the Niagara Manor, Buffalo, N. Y., with 30 members and 2 guests in attendance.

Librarian *Dick Davis* introduced the speaker of the evening, *King Ruhly*, sales manager, Chemical Division, Michigan Chrome & Chem. Co., who spoke on "Electroplating Rack Coating and Stop-Off Materials".

Officers elected for the 1960-61 season are as follows:

President, *Harold Shapiro;* 1st Vice president, *John Donaldson;* 2nd vice president, *Dick Davis;* 3rd vice president, *Robert Lienert;* secretary, *Robert Eich;* treasurer, *Roger Brown;* librarian, *John Tiebor;* sgt.-at-arms, *Ray Blechinger;* board of managers, *Bert Kirchhoff, Rolland Campbell* and *John Scholterer.*

G. William Bishop of the Carborundum Co., Niagara Falls, N. Y., was elected to membership.

The May 6th meeting concludes the activities of the Buffalo Branch until September 9th.

Robert E. Lienert,
Secretary

Blue Ridge Branch

The regular monthly meeting was held April 1st, at the Elks Club in Roanoke, Va. The attendance included twenty-four members and guests. *Dr. Nelson Murphy* presided over the business meeting, and nominations were taken for officers for the coming year. The elections will be held at the May meeting.

After the business meeting, those attending heard *Arthur Logazzo*, Nutmeg Chrome Corp., West Hartford, Conn., speak on hard chrome plating. Along with the talk he showed films which covered all phases of chromium plating. Everyone enjoyed the talk which covered everything from metal preparation to the finished product.

Donald H. McGee,
Secretary

Indianapolis Branch

The Electrochemical Society met with the Indianapolis Branch on Tuesday, April 5th, at the Construction League. Fifty-three attended the dinner and about twenty came additionally for the program. *Les Reynolds*, president, asked for the reports of the secretary and treasurer. A report on the coming Tri-State meeting was given by *Quentin Shockley*. Mr. Reynolds, who is also national membership chairman, asked that consideration be given by the Tri-State to appoint a membership committee within the Tri-State, and help get new members.

There has been no correspondence from national headquarters about the 1962 Interim Meeting.

Dr. Abraham Max, a past president and also a member of the Electrochemical Society, gave some interesting facts about the speaker but turned the actual introduction over to *Dr. Ralph Haberecht*, who introduced *Dr. Charles Faust* of Battelle Memorial Institute. His subject was "Some Aspects of Metalurgical Cleaning." Dr. Faust showed many slides to indicate his talk. The slides were blown up 40,000 times to show impurities of buffed surfaces of metal. He presented information on electropolishing, to show various flaws in metal after electropolishing and also after various plates had been applied. The meeting proved very interesting and many questions followed the talk.

Three applications for membership were read, *Donald Kinkaid, James*

Anoskey, and *Thomas Hathaway*. These will be voted on at the May meeting. The meeting adjourned at 9:30 P.M.

Edna Rohrabaugh,
Secretary

UPPER MIDWEST METAL FINISHING ASSN.

The association met on Monday evening, April 4th, at 7:00 P.M. at Jax Cafe in Minneapolis, Minn. with 40 members and guests present.

President *Carl Ahlgren* introduced the following guests; *Allen Brumm* of Remington-Rand Univac, *Donald Patterson* and *Charles Clark* of Michigan Chrome and Chem. Co., Detroit, *Dean Currie* of the Bureau of Engraving, and *Jim Hale* of C & H Chem. Co. In addition to the guests present, the following new members were introduced; *Roy Hutchins* of Continental Machines, *Bob Hood* of Turco Products, *Howard Johnson* of Lyons Chemicals, and *Ray Sauber* of Oakite Products.

Secretary - Treasurer *Bob Buckley* made an announcement that the Board agreed to change the accounting date for all transactions from the present fiscal year of June 1st through May 31st of each year to a calendar year basis beginning on January 1st thru December 31st of each year with the transition to take place immediately.

A preliminary announcement was made relative to the coming Annual Party which will be held on Monday evening, June 6th, at Jax Cafe in Minneapolis, in which it was announced that for the first time facilities will be provided to have a dance orchestra following the dinner. The announcement was made by Party Chairman *Bernie Olson*.

Program Chairman *Arthur Wendell* introduced the speaker for the evening, *Capt. E. Heidehreich* of the 3rd Army Battalion who spoke on the "Air Defense of the Twin Cities Area", which included slides and motion pictures showing the various Nike and other allied installations of area protection. This was one of the most interesting meetings which has ever been held as shown by those members in attendance.

The meeting adjourned at 9:20 P.M.

Bob Buckley,
Secretary - Treasurer

N.A.M.F.

The *National Association of Metal Finishers*, sole management organization in the contract plating and finishing industry, will hold its annual meeting at the Statler-Hilton Hotel, Los Angeles, from Friday, July 22 to Monday, July 25, 1960. A post-convention program will also be held, featuring a trip to Disneyland, and junkets to Hawaii and Las Vegas.

The first session will be held Friday morning and will include the traditional membership meeting and committee reports. An election of officers and directors' meeting will highlight the afternoon program. Local affiliate secretaries will meet in the evening.

The Saturday session will include the first management seminar in the morning, featuring *Dr. Ted Anderson* of UCLA who will discuss "Getting the Most Out of Job Shop Management." In the afternoon, *Dr. Orlo Brees* of the National Association of Manufacturers will talk on "Is It a Sin to Make a Fair Profit from Operating a Job Shop?"

The third and final management

seminar on Saturday will take in the usually controversial subject on costing methods. A panel of west coast platers will participate in this popular session.

Saturday evening's program includes a cocktail hour and reception, followed by NAMF's banquet, special entertainment and dancing.

Sunday is an "open" day, with conventioneers catching their breath and getting acquainted with Los Angeles and environs.

Monday's program includes a joint breakfast-meeting between NAMF directors and trustees of the Metal Finishing Suppliers' Association. Later, out-of-town platers will visit job shops.

SOCIETY OF VACUUM COATERS

T. J. La Bounty, past president of the Society of Vacuum Coaters and chairman of the Arrangements and Program Committee for the next national convention of this group, announces that plans are being completed for this meeting to be held at the attractive Lake Towers Motel, in Chicago, January 17th and 18th, 1961. At present, there is still some time available on the program for additional technical papers. Those interested in presenting a paper at this meeting should send an abstract to Mr. La Bounty, c/o Midwest Technical Service, Box 61, Downers Grove, Ill.

AMERICAN SOCIETY FOR METALS

Appointment of *T. C. DuMond* as manager, National and Regional Metal Congresses, American Society for Metals, has been announced by the Society. He has also been appointed director, membership and chapter relations, confirming a responsibility he has held for a number of months. He will provide liaison, counsel and direction from ASM headquarters to the Society's 31,500 members in 112 chapters throughout the United States and Canada.

Before joining the headquarters staff in 1957, DuMond served for ten years as editor of Materials and Methods magazine, now *Materials in Design Engineering*, and is author of three technical books.

T. C. DuMond

Appointment of *Fred L. Siegrist* as assistant editor of *Metal Progress*, monthly metals engineering publication of the Society, has also been announced. He joins the expanding editorial staff after three years as training supervisor for the home study school division, the Metals Engineering Institute. Prior to that he served as staff metallurgist at Aluminum Co. of

America, Lafayette, Ind., in development and quality control.

He is a veteran of over 12 years' experience in diversified metallurgical operations, including testing and evaluating high temperature alloys for jet engine applications at Wright Aeronautical Corp., Woodridge, N. J. He was also associated with Westinghouse Electric Corp., Pittsburgh, in research and development of nuclear reactor components.

A graduate of the University of Illinois in metallurgical engineering, he is a member of Alpha Sigma Mu, Tau Beta Pi and Phi Eta Sigma honorary societies. Other memberships include the American Welding Society and Metallurgical Society of AIME.

AMERICAN ZINC INSTITUTE MOVES TO NEW QUARTERS

As of Tuesday, May 3rd, American Zinc Institute, Inc. has occupied new and larger offices at 292 Madison Avenue, New York 17, N. Y. The new AZI phone number is now ORegon 9-6020.

The entire 14th floor will be occupied by the Institute, the full administrative staff of its expanded research program, and the Lead Industries Association.

A.S.T.M.

A searching look into the present state of knowledge of several facets of materials science will highlight the 63rd Annual Meeting of the American Society for Testing Materials at Chalfonte-Haddon Hall, Atlantic City, N. J., June 26-July 1, 1960. The Society's new Division of Materials Sciences has organized an all-day program for Monday, June 27, consisting of two symposia related to basic materials knowledge: "Symposium on Recent Progress in Materials Sciences" and "Symposium on the Nature and Origin of Strength of Materials."

The Society's technical committees and their subcommittees will hold between 900 and 1000 committee meetings during the week, and the biennial exhibit of testing apparatus and laboratory supplies will be held throughout the five-day week, opening Monday noon and closing Friday noon. Exhibitors will display their new developments in testing and scientific apparatus.

VOLATILE INHIBITOR MFRS. ASSN.

The national association, composed of manufacturers of volatile corrosion inhibitor products (VCI), held its semi-annual meeting in New York recently. *Edgar L. Orchard* of the Orchard Paper Co., St. Louis, was elected president of the association. Elected vice-presidents were *Walter Spencer*, Daubert Chem. Co., Chicago, Ill. and *James Anwyll, Jr.*, Marvellum Co., Holyoke, Mass. *Samuel Lawton, Jr.*,

attorney from Chicago, Ill. was re-elected secretary-treasurer.

At the meeting, pending revisions in military specifications were discussed by the membership. The association also discussed a broadening of statistics relative to the amount of volatile corrosion inhibitors currently being sold in the U. S. Other business included consideration of a brochure to be published by the group and the formation of a speakers bureau.

The association will hold its fall, 1960 meeting to coincide with other packaging industry meetings that are forthcoming. The meeting will be in the form of a symposium on volatile corrosion inhibitors.

SOCIETY OF DIE CASTING ENGINEERS

The Society has selected subjects and named program chairmen and session leaders for the technical congress to be held in conjunction with the First National Die Casting Exposition and Congress to be held in the Detroit Artillery Armory from November 8-11, 1960.

The Technical Congress will include eight separate sessions. One session will be held from 9:30 A.M. to 12:00 noon and the other from 1:30 P.M. to 4:00 P.M. in the Artillery Armory on each of the four days of the Exposition. Each of the sessions will have a minimum of three technical papers and/or panel discussions of the subject involved. Among the subjects will be anodizable die castings and finishing.

FEDERATION OF SOCIETIES FOR PAINT TECHNOLOGY

Henry F. Payne, professor in charge of organic coating research and technology at the University of Florida, Gainesville, Fla., has been selected to present the Annual *Joseph J. Mattiello* Memorial Lecture at the 38th Annual Meeting of the Federation, which will be held at the Hotel Sherman in Chicago, Ill. from October 31 through November 2, 1960.

The subject of his lecture will be "The Philosophy of Coatings."

News from California

By Fred A. Herr

A distinguished member of the Dutch metal finishing industry has joined the Southern California sales engineering staff of the Sel-Rex Corp. of Nutley, N. J., in the person of *Franz L. Hencke* of Apeldoorn, Holland. Mr. Hencke came to California early in March with his wife and five children and plans to make the United States his permanent home. His most recent post was that of supervisor of plating for Van Shothorst, N. V., in Barneveld, Holland. The firm is the largest man-

ufacturer and finisher of bicycle parts in Holland, particularly rims.

The bicycle, in Holland, according to Hencke, is a more widely used medium of transportation than in the United States and bicycle production is a major industry there. The firm for which he served as director of finishing employed 500 workmen for manufacturing and processing bicycle parts. The parts, he said, are given a finish equivalent to an automobile part finish. The plant is equipped with 2,000 gallon copper, nickel and chromium tanks.

The largest plating plant in Holland, Hencke said, is operated by the Phillips Co. in Eindhoven. The company is a manufacturer of electronic equipment, radios and television sets, and also has plants in Belgium, West Germany, France, and England.

Hencke was a charter member of a plating society organized in Holland about a year ago which is the Dutch equivalent of the A.E.S. Its name is Stichting Galvanotechnick, with headquarters in Utrecht, and branches in Amsterdam, Rotterdam, The Hague, and eleven other cities in Holland. The membership now is about 300. Hencke is a member of Arnhem Branch, but has already started his Americanization process by filing for membership in Los Angeles A.E.S. Branch. He attended the April 13 meeting of the Branch as guest of *Walter Walczyk*, western sales representative for Sel-Rex.

Meyer Roter, former Southern California job plating shop owner, has been named supervisor of the plating and printed circuitry etching department of Packard Bell Electronics, 12333 West Olympic Blvd., Los Angeles. Until August, 1959, when he sold his interest to partner *James Barker*, Roter was co-owner of Artcraft Plating & Finishing Co. in Burbank, Calif., which specialized in printed circuit plating.

The department at Packard Bell, over which Roter has direction of plating, specializes in the manufacture of printed circuit boards for use in its own computer division, as well as for other manufacturers.

H. R. Smith of the technical products division of the company has informed METAL FINISHING that new testing facilities have been acquired for research and development of new applications in plating electronic components, printed circuit boards and flushed circuit boards. New photoengraving equipment, laminating presses, and chemical analysis facilities have been installed for use in precision and subminiature circuit board work.

Kim Jung, who has been in charge of production for Alert Supply Co., Los Angeles, since the firm's founding ten years ago, has assumed most of the duties of general manager since the recent partial retirement of general manager *A. D. Gaskin*. Mr. Gaskin continues to lend his valuable services in consulting and advisory capacities but has relinquished the burden of full time management.

The Metal Finishing Assn. of Southern California, at a recent meeting, formally approved adoption of a six-point policy statement of established practices under which job shop metal finishers will process material. According to MFASC President *Jerry*

Burton of Culver City, Calif. the six points are:

1. Whenever we are given material with detailed instructions as to treatment, our responsibility shall end with the carrying out of the those instructions. Type of material, tolerances and specifications for processing shall be declared in writing prior to our processing.

2. Our liability for any cause is limited to cost of direct material of the product directly damaged by our processing, or three times our processing charge on such material, whichever is lower. Charges for our services are based on this policy limiting our liability.

3. Liability greater than outlined in Paragraph 2 will be assumed by us only when so agreed in writing by us. In such event a higher charge will be made for our services.

4. Parts and material as processed by us shall be presumed to be accepted as satisfactory by you if we are not notified of damages, shortages, or other discrepancies within ten working days of your receipt of same.

5. Where operations or processes performed by us are in the nature of "salvaging" parts or material, the work is accepted on a "best effort" basis, and no liability shall attach to us unless previously agreed upon in writing prior to our processing the job.

6. In the event results of metal finishing operations are unsatisfactory due to metal imperfections, changes in grade or composition of materials, and/or manufacturing imperfections, the customer would be required to pay the contracted amount of the finishing operation performed.

Carmelo De Luca, formerly with Artcraft Plating & Finishing Co. in Burbank, Calif., has gone into business for himself under the firm name of Space Age Plating Co. His 2,500 sq. ft. plant at 14710 Rayme St., Van Nuys, Calif., represents an investment of some $40,000 for building and equipment.

De Luca has equipped the shop with precious metal facilities, including rhodium, gold, and silver, for plating printed etched circuit boards, and other electronic parts. De Luca marked his advancement into the shop owner class by being initiated into membership of Los Angeles Branch, A.E.S., on April 13.

William Hartman has been appointed a field sales engineer in the Los Angeles area, for industrial aircraft, J. B. Ford Div., Wyandotte Chemicals Corp. He headquarters at the firm's offices at 8921 Dice Road, Los Nietos, Calif., a Los Angeles suburb. Hartman was formerly on the staff of the Mintre Corp., of Los Angeles, distributors of air filters and dust collectors.

James G. Baldwin has been named general manager of the western chemical division, Hooker Chem. Co. *Horace W. Hooker*, formerly divisional sales manager, has been transferred to the New York office. He has been succeeded as division sales manager by *Russell O. Vognild*. *George A. Gentes*, formerly production manager for the western chemical division, has been named chief engineer, with headquarters in Niagara Falls, N. Y.

Lester Gideon, quality control engi-

neer for Hughes Aircraft Co., Culver City, Calif., is the producer of a new scientific and engineering radio program which aired its first broadcast over Station KRKD, Los Angeles, in March.

The program is broadcast Sundays between 6:15 and 6:30 P.M. It features news and commentary on significant events of interest to science and engineering, news of societies, meetings, conventions, and technical conferences. A discussion of one society and its goals and history is presented each week. The Los Angeles Technical Societies Council is assisting with the program.

Three Los Angeles men are associated in the founding of Arizona Automatic & Metal Processing, Inc., Phoenix, which has filed articles of incorporation listing three million dollars capitalization. The firm will conduct a metal processing business, including designing, manufacturing, fabrication, processing and assembling. The incorporators are *Nile D. Adams* and *Robert F. Howard* of Los Angeles, and *John J. Morris* of Northridge, a Los Angeles suburb.

A. T. Leonard, national president of the National Association of Metal Finishers, was a Los Angeles visitor in April for conferences with *Jerry Burton*, president, and other officers of the Metal Finishers Association of Southern California. Conference discussion dealt mainly with preparations underway for the national convention of the NAMF which is to be held at Hotel Statler, Los Angeles, July 22 to 25.

The first session on July 22 will include a general membership meeting, election of new officers, and a meeting of local affiliate secretaries. The first of three plating management seminars will be held in the morning of July 23. *Dr. Theodore Anderson* of UCLA will lead the discussion on "Getting the Most out of Job Shop Management." In the afternoon, *Dr. Orlo Brees* of the National Association of Manufacturers will talk on "Is it a Sin to Make a Fair Profit from Operating a Job Shop?" The third management seminar will feature a discussion of job shop costing methods, with a panel of western platers participating to answer questions.

Plant visitations to four Southern California plating shops are on the program for July 25. The shops to be visited are Modern Plating Co. and Sanford Process, Los Angeles; Burton Silverplating Co., Culver City; and Crown City Plating Co., El Monte.

Manufacturers' Literature

Anodes and Plating Chemicals

Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

Specifications and recommended applications are given in Bulletin No. AC-112 for several styles of anode bags, and seven types of anodes. The bulletin lists salts commonly used in electroplating baths and a number of brighteners used in the firm's solutions. Standard package sizes are shown for these products.

Anodes described include nickel, cadmium, brass and bronze, copper, lead and zinc. Various types of nickel anodes are listed along with recommended applications and pH ranges. A page of line drawings tells how to order hooks for round, flat and shaped lead anodes.

Dust Collectors

Hammond Machinery Builders, Inc., Dept. MF, 1601 Douglas Ave., Kalamazoo, Mich.

Practical, effective ways for solving dust, dirt, and mist collecting problems in the plant are described in a new 16 page catalog, No. DK-820.

This informative text contains detailed explanations of how to achieve maximum results with various models in the line of DusKolectors, as well as general application information. Installation recommendations are also given for specific situations.

In addition to photographs, cutaway diagrams and floor plans, the bulletin gives features, dimensions, and specifications on each of the models, accessories and extra equipment.

Industrial Equipment

George Koch Sons, Inc., Dept. MF, Evansville 4, Ind.

An illustrated brochure is available on the above firm's industrial equipment. Three types of ovens — cabinet, shelf and truck — are listed, with specifications given for each, plus construction features and wiring diagram.

A section on flow coat units gives their advantages over spraying and dipping, answers questions on use, and lists typical products which are flow-coated. Information is also given on dimension, performance and capacity specifications of the firm's fans and blowers.

Polishing Heavy Chromium Plate

Lea Mfg. Co., Dept. MF, 16 Cherry Ave., Waterbury 20, Conn.

This new data sheet covers various abrasive finishing methods used to produce bright, satin or butler finishes on heavy chrome plate. Material includes recommended compounds, type of buff and buff speeds.

Abrasive Compounds in Barrel Finishing

Frederick Gumm Chem. Co., Dept. MF, 538 Forest St., Kearny, N. J.

This illustrated 4-page bulletin discusses various abrasive media, the type of deburring action required in specific applications and considerations in the selection of abrasive materials.

The bulletin also discusses the use of two basic types of deburring compounds, those non-abrasive chemical blends which are used with abrasive media to prevent chemical attack and provide better cleaning action, and those in which an abrasive material is combined with the particular chemical blend.

Flame Spray Process

Metallizing Engineering Co., Inc., Dept. MF, 1101 Prospect Ave., Westbury, N. Y.

A new 16-page engineering data bulletin on basic flame spray processes covers the metalizing process which sprays powdered metals.

In addition to covering the basic engineering considerations for each process, the bulletin includes tables and charts on specific characteristics of these coatings, such as hardness, tensile strength, bond strength, etc. Illustrated and described are typical applications.

Polishing Copper

Lea Mfg. Co., Dept. MF, 16 Cherry Ave., Waterbury 20, Conn.

A new data sheet on abrasive finishing methods and materials for copper plate includes such data as buff speeds, type of buff, proper liquid or bar abrasive compound and working hints. Types of finish discussed include color, high color, satin and butler.

Bright Chromate for Zinc and Cadmium

MacDermid Inc., Dept. MF, Waterbury, Conn.

MACro Brite L-10, a new leach-type bright chromate for zinc and cadmium, is fully described in Technical Data Sheet No. 99, a two-page usage and instruction sheet.

Paint Mask Washer

Conforming Matrix Corp., Dept. MF, 349 Toledo Factories Building, Toledo 2, Ohio.

A brochure describes three models of machines for high pressure spray washing of paint masks.

Organic Finishes

Finishes Div., DuPont Co., Dept. MF, Wilmington 98, Del.

An illustrated booklet explains the proper use of new rust-inhibiting finishes recently introduced, which are primarily primers which metalize the section affected by rust and corrosion and provide a perfect surface for subsequent coats of paint.

The booklet gives complete instructions for protecting all kinds of metal, and includes directions for choosing the right primer, preparing the metal for paint, and applying both primers and topcoats.

Drum Mixers

Process Equipment Div., The U. S. Stoneware Co., Dept. MF, Akron 9, Ohio.

Bulletin DM-290 highlights an expanded line of five standard sizes of "U. S." heavy-duty fiber drum tumblers. The bulletin shows a series of loading charts, from which the required size of drum tumbler can readily be determined according to the size of drums and weight of loads to be tumbled.

The literature also contains illustrations and specifications for drum rollers, conical blenders, tumblemixers, "Rocker-Roll" mixers and other special units and accessories for performing all types of drum mixing and blending operations. A complete description of each unit is given along with recommended applications.

Conversion Coating for Magnesium

MacDermid Inc., Dept. MF, Waterbury, Conn.

MACro Mag No. 1, a dry chromate base salt used in water solution to produce a corrosion resistant coating on magnesium, is fully described in Technical Data Sheet No. 100, a two-page usage and instruction sheet.

Ultrasonic Cleaning

Branson Ultrasonic Corp., Dept. MF, 41 Brown House Rd., Stamford, Conn.

A twenty-four page, illustrated brochure is available which gives information on ultrasonic cleaning principles, solutions and chemicals, transducers, power generators, and cleaning equipment.

Specialty Chemicals

Conversion Chem. Co., Dept. MF, Rockville, Conn.

A new, easy reference chart for metal finishers lists approximately 50 Kenvert items, including chromate treatments, bright dips, brighteners, plating additives, pickling and cleaning specialities, and protectives; all designed for specific applications.

Non Pitter for Cyanide Copper

MacDermid, Inc., Dept. MF, Waterbury, Conn.

A new surface active liquid, called Metex Non Pitter N-17, is fully described in Technical Data Sheet No. 81, a three-page usage and instruction sheet. The material is used in cyanide copper plating baths to overcome causes of blotchy plate and some causes of pitting, as well as to reduce fuming and dragout.

Plate Coils

Dean Products, Inc., Dept. MF, 616 Franklin Ave., Brooklyn 38, N. Y.

Bulletin M-10 is a new, easy-to-read technical explanation of how Panelcoils can be used for heating or cooling both flat and curved surfaces.

Dust & Fume Scrubber

The Ducon Co., Inc., Dept. MF, 147 E. Second St., Mineola, N. Y.

A new high energy dust and fume scrubber, The Oriclone, is described in a 4-page bulletin, No. W-8560. Also included are over-all dimensions, pressure drop vs. water rate curves, installation sketches and performance results in several difficult installations.

Ovens and Air Heaters

W. S. Rockwell Co., Dept. MF, 200 Eliot St., Fairfield, Conn.

Two new four-page illustrated bulletins are available. No. 127 shows twenty-one ovens for baking, drying, curing and heat treating. Bulletin 129 is concerned with direct gas fired air heaters and includes information on applications, construction, equipment and safety controls.

Repair and Preparation of Concrete Floors

Carboline Co., Dept. MF, St. Louis 17, Mo.

A 10 page bulletin, 1019, gives complete details of the proper repair and preparation of concrete floors prior to the application of organic protective coatings.

Included is a chart listing 9 separate conditions or stages of concrete floors commonly found in various plants. After each condition, the recommended repair method is explained in detail. The repair of concrete cracks and expansion joints is shown in diagrams. The procedure for determining the pH of the concrete is also explained.

Infrared Heat

Fostoria Corp., Infrared Div., Department MF, Fostoria, Ohio.

Bulletin 59-240, 8 pages, 2-colors, gives full information on pre-engineered modular oven components incorporating T-3 quartz lamps, quartz tubes or metal rods as sources for infrared heat.

Anodize Thickness Tester

J-R Engineering Co., Dept. MF, Wausau, Wis.

A catalog sheet illustrates in colors the "Anotron" low cost portable precision built electronic instrument for checking the thickness of anodized aluminum surfaces. Complete description of its operation, emphasizing all features, its low cost, etc. are included.

Heat Calculator

Dean Products, Inc., Dept. MF, 1048 Dean St., Brooklyn 38, N. Y.

Technical data sheet No. 78 offers an accurate method for determining the square feet of Panelcoil heating surface required to heat water to a given temperature, in a given time.

The only factors required are: 1. gallons to be heated; 2. to what operating temperature; 3. in what minimum time; 4. "U" heat transfer value; and, 5. operating steam pressure.

Infrared Heating

Fostoria Corp., Infrared Div., Dept. MF, Fostoria, Ohio.

Metal Processing Bulletin 57-108, 8-pages, 2-colors, gives full information on infrared ovens and components for metal processing applications. Typical installations are shown.

Nonionic Surfactants

Hodag Chem. Corp., Dept. MF, 7247 N. Central Park, Chicago 45, Ill.

A new bulletin describes the applications and tabulates the properties of 37 representative nonionic surface active chemicals. The products are divided into four groups: glycerol esters, other polyhydric alcohol esters, polyglycol esters, and polyoxyethylene alkyl aryl ethers. The new bulletin suggests the considerable variety of chemicals that are available within each of the groups.

Rhodium Plating

Texas Instruments, Inc., Metals & Controls Div., Dept. MF, 34 Forest St., Attleboro, Mass.

A plastic-laminated instruction sheet on the use of rhodium plating solutions is designed for mounting on or near the rhodium plating tank for

quick reference. The sheet gives instructions on making baths for decorative and industrial rhodium finishes, and on preparing surfaces for plating. The sheet also includes general suggestions on good rhodium plating procedure. Methods for determining the cost of a plated surface and how to correct common plating defects are outlined. Other data are given on equipment, area calculations and useful equivalents.

Alkaline Deruster

MacDermid, Inc., Dept. MF, Waterbury, Conn.

Metex Alkaline Pickle M-613X, a new cyanide-free rust removing compound in dry powder form, is fully described in Technical Data Sheet No. 97, a three-page usage and instruction sheet.

NEW BOOKS

Electropolishing, Anodizing and Electrolytic Pickling of Metals

By N. P. Fedot'ev and S. Ya Grilikhes. Published by Robert Draper Ltd., 85 Udney Park Road, Teddington, Middx., England. 1960. 285 pages including index. Price: $8.65 postpaid.

Of major interest to this reviewer was the advanced stage of development in the art of electropolishing steel with which the Russians are to be credited. In this volume, ably translated from the Russian by A. Behr, is evidence that they are using the process much more widely than we are on an industrial scale. Included in the presentation are the theory, effect on metal properties, and applications to all the commonly employed metals. The book is generously illustrated with 81 figures and 60 tables and, although the emphasis is on the Russian developments, it is a comprehensive and authoritative summary of the subject.

Electrolytic and Chemical Polishing of Metals

By W. J. McG. Tegart. Published by Pergamon Press Inc., 122 East 55th St., New York 22, N. Y. 1959. 139 pages including appendix and index. Price: $6.50.

This is the revised edition of the volume which first appeared in 1956, and brings up-to-date a critical summary of the subject from a theoretical and practical viewpoint. Although the metal finisher will be most interested in the collection of formulas and operating procedures for different metals, both common and uncommon, study of the preceding chapters is highly recommended. These chapters deal with the mechanisms, principles, effects of variables, and electrical characteristics. Familiarity with these will aid in controlling the processes on an industrial scale. This book may be considered both a text and a reference handbook and will be a valuable addition to the finisher's library, containing, as it does, almost every formula disclosed during the twenty-five years which have elapsed since Jacquet first published his work.

Finishing Handbook and Directory

Edited by C. S. Woollard. Published by Sawell Publications, Ltd., 4 Ludgate Circus, London E.C.4, England. 1960. 524 pages including index and directory. Price: 37s. 6d. plus postage 7/6.

The latest edition of this handbook, which is available at the above price with a year's subscription to *Product Finishing* magazine, contains 21 chapters devoted to various aspects of metal finishing, including vitreous enameling, vacuum coating, and painting. Fully revised, the book contains a number of British procedures which will be of interest to American readers, as well as a new 32 page alphabetical guide to finishing. The directory section, which would not concern finishers on this side of the Atlantic, lists some 1,500 supply houses and custom finishers, under more than 400 headings, and over 3,000 trade names.

ASTM Standards on Metallic-Coated Iron and Steel Products

Published by American Society for Testing Materials. 1916 Race St., Philadelphia 3, Pa. 1959. 164 pages. Price: $3.50.

Sponsored by ASTM Committee A-5 on Corrosion of Iron and Steel, this volume presents, in a convenient form for reference, the various standard and tentative methods of test and specifications for zinc-coated sheets, wire, pipe, etc., aluminum-coated products, and terne-alloy-coated sheets. Included are certain specifications on wrought iron, on wires for electrical conductors, and on non-ferrous metals and alloys.

OBITUARY

DAN SISK

Dan Sisk, Chicago district sales engineer for *Kolene Corp.* of Detroit, died April 13, 1960. He was a member of the American Society for Metals and had been with the firm since 1943.

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Udylite semi-auto — plating machine on 2400 gal. rubber lined tank, size 54" x 18 ft. and 48" deep. 2 Karbate heaters like new, cheap. Address: June 2, care Metal Finishing, 381 Broadway, Westwood, N. J.

NEW AUTOMATIC DEGREASER

Never been used. Automatic cross rod conveyorized Circo degreaser. Vapor-spray-vapor. Complete, with solvent recovery still, pumps, storage tank, filters, work baskets, controls. Solid stainless steel construction, var. speed drive. Cap. 5000 lbs. steel per hr. Basket size 24" x 20" x 8" high. Original price $16,500. Best reasonable offer for quick sale.

CHEMICAL SERVICE CORPORATION
82 Beaver St. New York, N. Y.

ALMCO SUB-O-MATIC

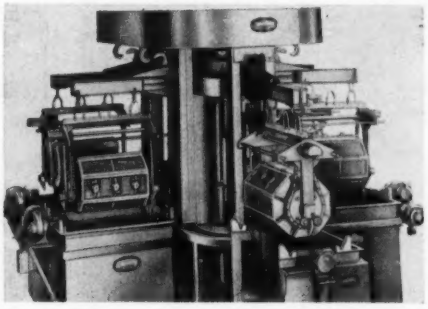
8 Station Submerged Barrel Finishing Automatic

FOR

High Production Descaling, Deburring, Grinding and Burnishing

WITH

Automated Programing for one man operation in materials handling and magnetic or vibration type separation.
NEW 1957. Excellent condition.



PLATING MACHINES

Udylite Anodizer and Chrome plater • Stevens Zinc plater
H-VW-M Copper Nickel Chrome and Zinc plater

MISCELLANEOUS

Generators 4000 Amp. to 2000 Amp.
6 Rotary Buffers and Polishers
3 Acme Straight Lines
Permutit Demineralizer with Programmed Cycling and Recharging

50,000 lbs. Copper bus bar ¼" x 4"
Filters 1200 to 25000 GPH
20 Assorted Buffing Jacks
45 Acme Automatic Heads
10 Semi-Automatics

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Plating, Polishing, Grinding, Spraying, Baking, Casting
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EQUIPMENT

June 10, 1960

John Doe Finishing Co.
123 Some Street
Anywhere

Gentlemen:

Due to consolidation and merger of our four warehouses and plants, we are LIQUIDATING approximately 70,000 square feet of used and new plating, polishing, spraying and degreasing equipment, chemicals, anodes, motors, machinery and supplies - FOR WHATEVER THE MARKET WILL BRING.

New replacement cost of the items in this liquidation is well over $1,500,000.

Call, wire, write or visit our warehouses for the opportunity to equip your plant with labor saving automatic and semi-automatic equipment and your daily operating supplies at ridiculously low costs.

WE ARE NOT GOING OUT OF BUSINESS, but are consolidating to serve the industry more efficiently.

Yours truly,

PESCO PLATING EQUIPMENT CORP.

Harvey S. Levine

Harvey S. Levine

t/rj

In River Edge, New Jersey
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In Englewood, N. J.
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CLEANING • POLISHING AND BUFFING • ELECTROFORMING
ANODIZING • RUSTPROOFING • PLATING • BARREL FINISHING
VACUUM METALIZING • LACQUERING AND ENAMELING

SITUATIONS OPEN

TECHNICAL SERVICE

SITUATION OPEN — Continued expansion in our Electroplating Division has created a requirement for additional personnel in field service. Candidates should have several years' experience in field service, requiring knowledge of electrodeposition processes.

Interviews may be scheduled during the American Electroplaters' Society meeting in Los Angeles. Please send detailed resume including salary requirement to: Personnel Dept., The Harshaw Chemical Co., 1945 E. 97th St., Cleveland 6, Ohio.

RESEARCH CHEMIST

SITUATION OPEN—Harshaw has an immediate opening for a research chemist in the Electroplating Division. Candidates should have either 1) M.S. or Ph.D. in physical chemistry, or 2) M.S. or Ph.D. in physical chemistry plus some experience in some phase of electrochemistry, or 3) B.S. in chemistry with at least 5-10 years' experience in electrodeposition.

Interviews may be scheduled during the American Electroplaters' Society meeting in Los Angeles. Please send detailed resume including salary requirements to: Personnel Dept., The Harshaw Chemical Co., 1945 E. 97th St., Cleveland 6, Ohio.

SALESMEN

SITUATIONS OPEN — Wyandotte Chemicals Corp., J. B. Ford Div., wants aggressive salesmen with 5 years metal cleaning, plating or paintroom experience to call on metal finishing and allied industries. Some chemical or engineering training desirable. Commission with guaranteed monthly draw. Excellent opportunity for advancement. Liberal retirement, insurance and hospitalization program. Car furnished. Explain qualifications and experience fully when applying. Write Wyandotte Chemicals Corp., J. B. Ford Div., Wyandotte, Mich.

SALES ENGINEER

SITUATION OPEN—Man with knowledge of polishing and buffing to fill opening in progressive, well established southwest Michigan machinery building organization. Capacity to work and willingness to travel are primary requirements. Address: June 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

GRADUATE CHEMIST ELECTROPLATING

SITUATION OPEN—Required by precision precious metal plating department of electronic instrument manufacturer. Minimum 5-10 years experience. Excellent working conditions and benefits. Bergen County. Send reply to: June 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

SITUATIONS WANTED

PLATING FOREMAN, MANAGER

SITUATION WANTED—Twelve years diversified experience in job shop plating, managing, supervisory control, trouble shooting. Maintenance and control of most all plating solutions, anodizing, Dow treatments, black oxide finishes on all metals, phosphating, plating on aluminum, burnishing, deburring, barrel plating operations, polishing, plating die castings in production. Seek permanent position commensurate with my capabilities. Industrious, honest, dependable, preferred location, New York area. Address: June 5, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLATING-POLISHING SUPERVISOR

SITUATION WANTED—I have had over thirty years of experience in various types of metal finishing — making up, controlling of all plating solutions, installation of plating, anodizing and polishing equipment, still and automatic. Efficient in training help and organizing production. I've been working in large job shops where I supervised over 100 in help as well as in manufacturing plants as metal finishing supervisor with over 250 men. Address: June 6, care Metal Finishing, 381 Broadway, Westwood, N. J.

SALESMEN

SITUATION WANTED—Age 40. Have had twenty years' experience in all types of job plating, laying out of complete coloring plants, have knowledge of all types rectifiers, and chemicals. Would like position as salesman for New England areas for chemical house dealing with equipment and plating materials. Have had experience selling locally. Address: June 7, care Metal Finishing, 381 Broadway, Westwood, N. J.

SUPPLIERS OF EQUIPMENT AND MATERIALS AND ADVERTISERS INDEX

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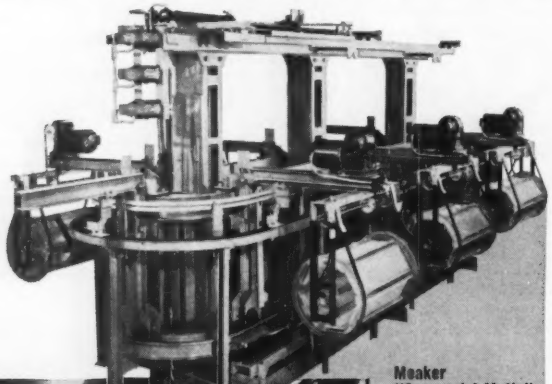
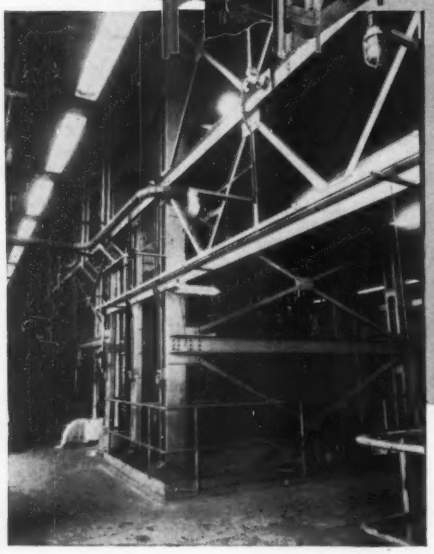
Automatic equipment and systems for continuous or batch metal finishing...from the "compact-a-matic" for precision plating of small components with limited production...to the world's largest automatic plating installation occupying 180,000 square feet... MEAKER has been the preferred source *since 1899*.



Meaker "Compact-A-Matic"



Partial view of world's largest automatic plating installation

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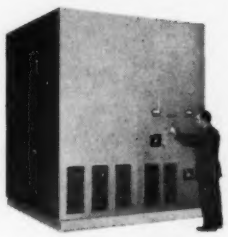
Silicon • Selenium

Dependable DC power for electroplating, electropolishing, electrocleaning and anodizing.

Units from 25 to 50,000 amps with manual, automatic and remote controls "custom-engineered" to your requirements—at no premium in cost.



Sel-Rex® JET PLATER®

For Precision High-Speed Precious Metals Plating

The complete precious metals plating facility in a single compact cabinet can be used for either rack or barrel plating...perfect for precision-plating of critical electrical or electronic parts, specification precious metals plating or "pilot plant" set-ups.

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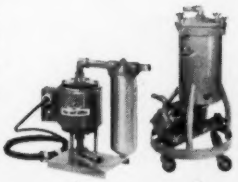

1 2

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***SEL-REX BRIGHT GOLD** – the standard of the industry –twice as hard as ordinary 24K Gold Plate–mirror-bright in any thickness, directly from the bath.

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BRIGHT RHODIUM PROCESS – yields brilliant, fine grained, non-tarnishing deposits. Manufactured in our own air conditioned laboratories, its purity assures consistent quality results for all decorative applications.

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FOR LOWER CHROMATING COSTS

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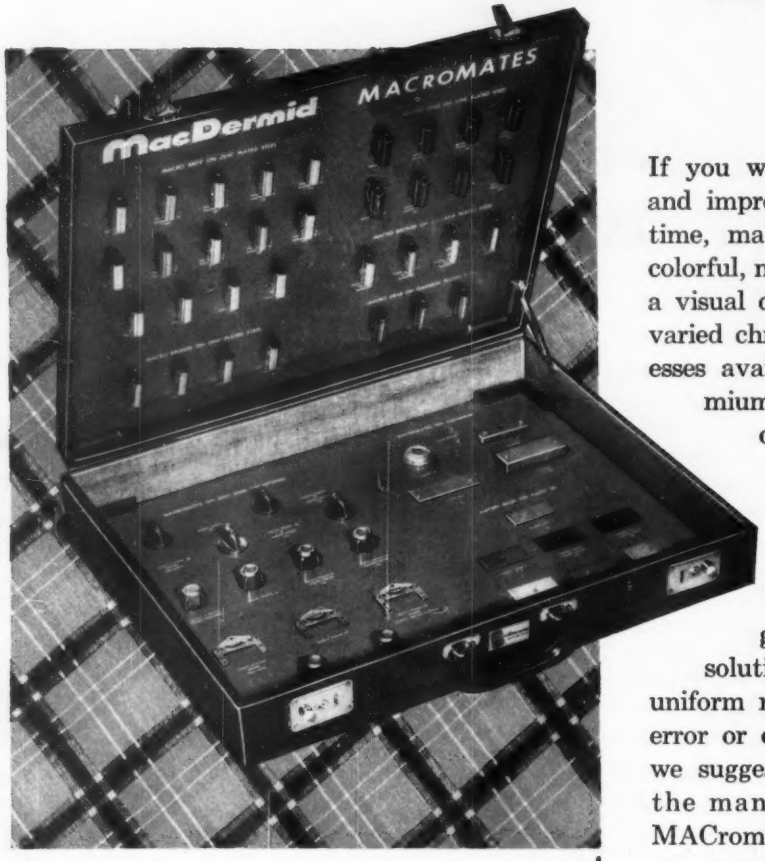
. . . See the man from MacDermid with the MACROMATE KIT



If you want to lower chromating costs and improve product finish at the same time, make sure you see MacDermid's colorful, new MACROMATE KIT! You'll see a visual demonstration of the many and varied chromate conversion coating processes available for plated zinc and cadmium, zinc diecasting, aluminum and other metals. And, best of all, your MacDermid man's complete cycle know-how can show you how MACromates can reduce chromating costs by producing more work per gallon of solution. MACromate solutions are easy to control, get you uniform results without costly trial-and-error or expensive reject problems. May we suggest that you sing out *soon*—for the man from MacDermid with the MACromate Kit!

A few of MacDermid's famous MACromates:

MACroBrite 2—an acid salt used with water to produce clear bright chromate coatings on zinc plate. Produces chromium-like blue tint.

MACroBrite L-6—for clear bright leach-type chromate finishes on zinc or cadmium. Silver-white finish.

MACroAlum 4—a powdered material used with water to produce a single-dip clear protective oxide film on aluminum. These coatings may be dyed.

MACroAlum 5—a powdered material used in water to produce a brass or bronze colored chromate coating on aluminum without loss of brightness.

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